THE
TROPICAL AGRICULTURIST:
JOURNAL OF THE
CEYLON AGRICULTURAL SOCIETY.

VOL. LVII. PERADENIYA, AUGUST, 1921. **No. 2.**

THE CULTIVATION OF LIMES.

Since the depression in the rubber industry, interest has been evinced in the possibilities of new agricultural crops for Ceylon. Numerous enquiries have been made regarding the cultivation of limes and with a view to providing practical information for prospective cultivators the Department of Agriculture has published in Bulletin form full details regarding cultivation and preparation of crops.

Limes have been grown systematically in the West Indies with considerable success during the past twenty years and the agricultural wealth of some of those islands is dependent upon their lime growing industries. There is a steady demand for lime products and the supplies do not at present appear to be exceeding demands.

Limes grow well in all districts of the colony where the rainfall is adequate up to a height of about 2,500 feet. Numerous specimens which are heavily laden with fruits are seen in all the damper districts of the low-country and they appear to be healthy and free from pests and diseases.

Systematic cultivation of the lime was commenced at the Anuradhapura Experiment Station in 1917. This Station is situated in the dry-zone and therefore it was the intention that they should be grown on irrigated areas. When irrigation has

been regular growth has been excellent and the first crops of fruits are now being reaped. When irrigation has been less regular several losses have occurred and the plantation is irregular. With the North-east rains supplies are being put in, and attention given to regular irrigation.

The lime requires a fairly regular rainfall and therefore should not be planted in areas subject to severe droughts.

It is impossible to estimate whether crops in Ceylon will equal those of the West Indies and therefore until further investigations have been made and the results of experimental plantings ascertained it is advisable for prospective growers to proceed cautiously and only to plant up comparatively small areas for experimental trial.

Limes are comparatively easy to cultivate and there should be no difficulty in regard to cultivation in Ceylon. They are grown from seed planted in specially prepared nurseries and the seedlings are planted out when they are 1 foot to 15 inches high. In drier districts smaller seedlings have given better results than larger ones and show less dying back upon transplanting.

Details are given in the bulletin of the various commercial products of the lime and their methods of preparation. In the early days, while experiments are being carried out, it is probable that concentrated lime juice will be the most suitable form in which to export lime products, while if the industry expands citrate of lime will be the most attractive product.

Exhibits of citrate of lime and of concentrated lime juice were exhibited at the Department of Agriculture exhibit at the Galle Agricultural Show and attracted considerable interest and attention.

Supplies of seed will be secured for prospective cultivators by the Department of Agriculture and enquiries for further information are solicited. The analysis of the limes grown in different districts is now being undertaken and such investigations will indicate whether the citric acid content of limes in Ceylon is equal to those of the West Indies.

RUBBER.

THE THINNING OUT OF RUBBER:

ACCORDING TO YIELD-RECORDS AND THE OCCURRENCE OF BROWN BAST.

Lecture given at a Meeting of the Rubber Planters' Association of Java, Bandoeng, 23rd February, 1921, by MR. J. R. HARMSEN.

Translated from the Dutch by MR. A. C. TUTEIN-NOLTHENIUS, West Haputale Estate, Ceylon.

If there is one disease which has changed our views regarding the cultivation of Hevea rubber, surely it is that of Brown Bast.

The disease has put so many problems before us in our practical work, that we have learned to understand what a great, but also profitable, field of study lies in front of us. I say "profitable" because owing to combating this disease we hope to put the entire area under cultivation on a sounder basis with all the benefits attached thereto.

Together with the change in the present system of tapping, on which I hope to publish some figures at our next meeting, one of the most important questions in connection with the Brown Bast disease is the problem of selecting and thinning out.

Having carefully collected records on selection and thinning out, it is now possible to get a better insight of the work we have been carrying out during the last years.

As on other rubber estates, it was tried to increase the yields on the divisions Tjikoempaj and Tjipinang as much as was possible by thinning out according to selection. I would like to put the results obtained before you. The oldest clearings on both the divisions are Tjikoempaj V and Tjipinang III. Both clearings were planted during the West Monsoon of 1910-1911 and regularly thinned out.

Originally the trees were planted 4 × 4 Meters (13 ft. × 13 ft.) and in January 1915 approximately 625 trees per H.A.* were ready for tapping.

The first years, the bad types of trees were removed, such as irregular ones, trees badly attacked by "Corticium," trees with poor quality bark, sickly and badly grown trees, etc., etc.

All trees which soon after tapping showed signs of Brown Bast were removed as much as was possible.

Following this method of working, in 1917 the fields were thinned out to 400 trees per H.A. and by degrees the observations on latex yields which had been started that year, began to have value. During 1917 the thinning out took place according to the yield records and at the end of that year an average of 290 to 300 trees per H.A. remained. During 1918 and 1919 this programme was followed and in accordance with the yield records thinning out took place pretty severely although the best use of the soil and the yields in our yield-books were taken into consideration.

* 1 Hectare = 2·47 acres.

The results that can be obtained by such a method of thinning out, I hope to publish in due course, for the present the following figures will suffice. Both estates have an acreage of 30 H.A.

During May 1919, the field Tjikoempaj V had 7,415 trees, giving a total yield of 1,375 K.G. during that month, or 6·3 gram dry rubber per tree at each tapping.

In December 1919, 1,779 trees remained, giving a total of 1,411 K.G. produce or 9 gram dry rubber per tree. This means that after having thinned out nearly one-third of the total number of trees, we still got an increase in yield. After December the thinning out was stopped; in July 1920 we obtained a yield of 9·9 gram dry rubber per tree at each tapping which proves that the thinning out is not making itself felt as yet.

The following figures are for the division Tjipinang III.

May 1919, 6,878 trees giving a total yield of 1,161 K.G. or 5·9 gram dry rubber per tree at each tapping.

December 1919, 5,300 trees giving 1,161 K.G. produce or 7·4 gram dry per tapping per tree.

These figures bear out that as the result of observations on yields, good results can be obtained by thinning out and that the figures collected during these observations have not been far wrong. The question is now, how were these yield-records obtained?

During 1917 four observations were recorded, during 1918 and 1919, 10 and 5 respectively. During and a month following the wintering of the trees, no notes were taken. The check on the observations was as follows.

The kanakapullai in charge of the experiments put, as is usual, the latex in a measuring glass, the amount of latex being recorded at once in a special register and then poured into a pail specially consigned for that purpose. The tapping round having been completed, the pail was at once taken to the store or factory and the total amount of latex remeasured and compared with the kanakapullai's total If the difference was more than 200 gram, (the yields of 325 trees were recorded daily), the kanakapullai was ordered to measure the same tapping round the next day, luckily this hardly ever occurred. Figures collected in this manner can be considered pretty accurate. Sometime afterwards the figures were checked in the field by making the K.P. pour the latex back into the cup, after which the assistant could take measurements. If the K P.'s figures were found to be wrong, a small fine was imposed and the man ordered to measure again next day. By degrees we obtained 19 records of value at the end of 1919.

When the thinning out took place the records were always taken to the field as I do not believe in marking the trees separately. The drawback of marking is that it necessitates a special check while every now and again the marks have to be renewed. They are not clear at a distance, while the work is made more difficult as well as tiring by needless walking about. At the beginning of 1920 I started another scheme as the thinning out at the hand of our records proved to be more and more difficult.

The yields of each separate tree collected during the current 3 seasons were added up and this total divided by the number of observations taken which gave us the average yield for the 19 experiments made. In this manner we got suitable figures for comparison, as the mistake made by the tapping of different tapping surfaces, as well as the changing over of tapping rounds was eliminated.

The average yield having been obtained, the trees were divided into the following classes :—

Class 1 : trees with an average of 1-20 gr. latex
Class 2 : ,, ,, ,, ,, ,, 20-30 gr. ,,
Class 3 : ,, ,, ,, ,, ,, 30-40 gr. ,,
Class 4 : ,, ,, ,, ,, ,, 40-50 gr. ,,
Class 5 : ,, ,, ,, ,, ,, more than 50 gr. latex,
(average yields)

So as to know at once the different classes in the field, the trees were marked thus :—

Class 1 : trees are not marked
Class 2 : one band of green paint, 6 feet above the ground.
Class 3 : ,, ,, ,, white ,, ,, ,, ,, ,,
Class 4 : two bands of white paint, ,, ,, ,, ,,
Class 5 : one band of red paint, ,, ,, ,, ,,

At the time of thinning out we now know at once what to do in the field, as well as what we will have to do in the future.

It may happen that a big number of poor yielding trees are found closely together in such a way that if all were to be removed at once big open spaces would occur, this is undesirable for several reasons and would mean a wastage of the land in our possession. It is therefore better to study the position of better yielders towards this group of poor trees and thin out slowly so that more room will be got for developing the crowns of the better yielding trees.

The cost of marking the trees with paint (about 3 to 4 guilders per H.A.) is well repaid as it is easy to spot the trees which have to be removed while the work will take less time and less trouble.

Thinning out is not so easy that one can lay down practical rules in a few words in accordance with a system one wishes to follow ; the reverse is the case, thinning out of rubber is one of the most difficult undertakings which demands great care and responsibility.

The system followed to date was limited to letting the most healthy and strong trees remain, after which thinning out was done according to the best yielding trees. The question is, can we leave it at that ? Will our views alter if we study how these good yielders conduct themselves towards the brown bast disease ? This was one of the questions which I put myself when the class index had been completed.

To get an idea of this, the attacks of brown bast in the different classes was carefully studied and the figures obtained were so convincing that it is interesting to go into these more fully. In the records, given herewith, you will find the trees of the divisions Tjikoempaj V. and Tjipinang III, classified as to the class-index mentioned. These divisions have been divided into blocks of one H. A. each, on the boundaries small corners remained so that some of the blocks, for instance No. 109, 117, 119, etc., of the division Tjikoempaj V, have got only a small number of trees.

The total number of trees in each block has been recorded as well as the number of trees attacked by brown bast, while these have again been split up according to the class-system. The boundaries of the blocks only divide the whole field so it says little if in one block a big percentage of diseased trees are found while another block shows a very small number.

On the division Tjikoempaj V. for instance we find block No. 191 with a total of 147 trees of which 63 have been attacked by brown bast ; in block No. 177 with 139 trees, only 6 trees have got the disease. For Tjipinang III we find great differences for the blocks No. 98 and 63.

Comparing the classes separately we notice the same, for instance in the division V, block No. 198 of 155 trees, 17 are diseased while 12 trees of the highest class are all healthy, but block No. 189 gives exactly the same figures.

It is unwise to imagine that owing to soil conditions, methods of cultivation are due to other reasons, a smaller number of trees were attacked in both these blocks. It is more likely that trees of greater resistance to the tapping system followed were accidentally found together in one block, as in the other classes, for instance IV, 4 trees out of 11 were found to be diseased.

Owing to lack of knowledge of the material under study we come across records which we cannot explain more in detail.

To get as good a record as was possible, the separate figures of each division were taken and the average found.

Comparing these averages we find for Tjikoempaj V in class 1, 13·9% of the trees attacked by brown bast, (B.B.) for class 2, 17·8%, class 3 with 23%, class 4 with 25·7%, and class 5 with 31%.

For the division Tjipinang these figures are ; 10·3%, 19·5%, 24·9% 26% and 39·8%.

On this division two blocks are found which give absolutely abnormal figures : blocks No. 51 and 96 give total of 306 and 361 trees per H.A. These blocks are in a low lying position on flat land with a heavy bank of "tjadas" as undersoil. The trees here are very poor and hardly give any yield, a thing we notice in the class-index.

As expected attacks of brown bast are rare here ; as I have pointed out some time ago, poor yielding and sickly trees are not much trouble by brown bast.

To get a careful comparison, it is better to ignore these two blocks on Tjipinang III, the figures obtained altering therefore somewhat.

After this correction, we find :

Total No. of trees 4672 of which 785 or 16·8% attacked by brown bast.
Class 1 : 2500 trees, 291 or 11·6% attacked by brown bast.
Class 2 : 1282 trees, 253 or 19·7% ,, ,, ,, ,,
Class 3 : 592 trees, 148 or 25%. ,, ,, ,, ,,
Class 4 ; 186 trees, 48 or 25·7% ,, ,, ,, ,,
Class 5 ; 112 trees, 45 or 40·1% ,, ,, ,, ,,

Taking the figures for both divisions together, we find :—
Total 9093 trees, 1571 or 17·2% attacked by brown bast.
Class 1 : 4397 trees, 555 or 12·6% attacked by brown bast.
Class 2 : 2785 trees, 522 or 18·7% ,, ,, ,, ,,
Class 3 : 1247 trees, 299 or 23·9% ,, ,, ,, ,,
Class 4 : 404 trees, 104 or 25·7% ,, ,, ,, ,,
Class 5 : 260 trees, 91 or 35·% ,, ,, ,, ,,

Above figures are the averages obtained on approximately 60 H.A. of well and evenly grown rubber with an average character of soil.

What do these figures teach us ?

1 That as the average yield per tree increases, the attacks of brown bast become more numerous.

2 That the trees in class 2, trees which give an average yield of 20-30 gram dry rubber, give an average percentage of diseased trees which is very nearly the same as the percentage for brown bast trees on the whole estate.

3 That among the trees in the higher classes, the percentage of attacked trees is further away from the average (of the whole estate).

4 That severe thinning out based on the best yielding trees determined by a given tapping system, can prove fatal and may lead to a serious increase of brown bast. Say we succeed in thinning out the divisions Tjikœpaj V and Tjipinang III, bringing the present average of 150 trees per H.A. to 100 trees per H.A. and that it were possible to reduce the first class to approximately 3,000 trees in about two years time, including all brown bast trees in this class ; this would lead to an increase of 8·5 % of attacked trees on the whole estate, the number of trees in the other classes being maintained in the meantime. I do not include the increase in disease among trees of the higher classes during these two years.

The advantage of thinning out according to selecting the best yielding trees is not as great as may be imagined, because of the best yielders have to be left out of tapping, the average yield cannot be greater and the yield from a tree which belongs to a lower class ; not counting the cost of treatment. In the case of Tjikœmpaj, where diseased trees are not left out, we tap these less severely so that the good yielder will come under one or even two or three lower classes.

Every one will try to increase the yield on his estate as much as possible at the same time trying to keep down the percentage of diseased trees. The only way out, if thinning out can be followed to the best advantage, is to combine it with the tapping system, i.e., we have to discover a method which will allow us to tap the best yielding trees with a minimum of danger of brown bast increasing.

For instance tapping on one cut of half the circumference every other day is an advantage as in the long run the same production as got by tapping on two cuts on a quarter of the circumference and daily, is obtained, while the number of trees attacked by brown bast decreases.

Although the result will be published later, for the present some figures to give you an idea may suffice.

In 1919, during 8 months, 497 cases of brown bast were discovered on Tjipinang IV, (tapping, two cuts on one quarter) while during the same 8 months in 1920 when tapping was altered to one cut over a half and every other day, only 36 new cases of brown bast were noted and the check taken showed the same total of attacked trees as during former seasons.

Following this method of tapping we can reduce the attacks by brown bast and get the same yield of latex.

It will be understood that in the different classes the number of diseased trees will increase if we proceed with this method of tapping increasing its severity in the lower classes according to the percentage figures.

On the division Tjipinang, where this method of tapping is in use, it has been proved, although not many data as yet are to hand, that even with this system of tapping most of the trees in the higher classes will be found attacked.

As a general rule we may take it that we can improve much by the method of tapping; the success obtained by tapping every other day, one cut over half the circumference, points out the direction we will have to follow, as we get with the same or even slightly increased yield per acre, a markable decrease in the attacks by brown bast.

Thinning out according to selection may be of advantage in the future if we study the results of thinning out in the different classes and compare these with the appearance of brown bast and the altering in the tapping systems.

Say we could, by introducing a still less severe system of tapping, (for instance tapping every third day, one cut on half the circumference, or every other day, one cut on a quarter) reduce the attacks of brown bast to a minimum, so that only a few weaklings alone would have the disease, although the yield per acre would decrease, thinning out by selection would increase the production to a normal basis but without the danger of new cases of Brown Bast occurring.

When at the start many trees are found per acre, the susceptible trees can be removed and it will be possible to get an entirely healthy estate, as the few trees, attacked at a later date (age) can be treated by the method of combating this disease.

We have greatly advanced in the treatment with hot tar and all trees can without an exception, be cured, but this may never be a reason to undervalue the danger of a disease like brown bast, as it is too much a proof of the wrong treatment the individual trees have received.

The fact that the disease is noted so much in highly producing trees and can be reduced by tapping on alternate days, proves the results obtained by past experiments as well as the verdict that the stimulus resulting out of repeated re-wounding and the poverty of the tissues owing to too severe latex-abstraction, in the long run makes the symptoms of wound degeneration reappear.

Let us return to the subject of thinning out.

As long as we are not very certain about the tapping system we ought to follow and for the present only use what in our opinion is the best method, it is a necessity to collect figures about the work we have in hand so that we may compare and can study the results.

For the present I hope to do the thinning out as follows :—

1 All trees which have a bad position, bad types of bark (outside), badly attacked by "djamoer" or root fungus, forked trees which are easily damaged by wind, badly crowned trees, etc., etc., to be removed as soon as possible.

2 To value the trees and divide them into classes as soon as is possible, according to records on yield and bark examination.

3 All trees which are attacked by brown bast soon after having been brought into tapping, to be removed at once.

4 To treat all really good trees as best as is possible (favourably) from the very start.

5 To thin out the classes according to outward appearance, crown-forming, etc., because although a heavy crown may not mean a good yielding tree, it nearly always is a proof of good bark-renewal.

For the present, after a rubber clearing has been in tapping for a couple of years, we will have to decide in which class, a special system of tapping being followed, the smallest percentage of brown bast trees is found, after which we can try to discover if there is a better combination of a tapping system and the appearance of the disease in the different classes.

It will be unnecessary to impress the value of figures on yields per acre, yields per tree and records of diseased trees being collected for the planter as they will be a guide for the future management.

We must not forget that we work for the interest of a "special-cultivation" as the dutch farmer would call it.

To obtain the best results in a special cultivation, it is essential to record the work done in special figures so that the future results obtained can be understood: only by this method alone we will know if we progress in our work and in the right direction.

The good results will be a compensation for all our troubles.

THE YIELD FROM INDIVIDUAL RUBBER TREES.

RUDOLPH D. ANSTEAD,

Deputy Director of Agriculture, Planting Districts.

I have received the following very interesting letter from a rubber planter :—

"I see in this week's *Chronicle* that you have given very interesting figures regarding the yield from individual trees in an experimental plot of coffee, and this has prompted me to give you the following figures, which you may publish if you care to do so.

"It is as well to mention that the investigation was made by me because of the abnormally high percentage of scrap in my total crop, and also because the yield of the estate was poor, and I conceived that a careful investigation and census would enable me to discover what was wrong.

"The field so carefully investigated has for many years given high yields per acre. It consists of 61·15 acres, and was planted 20 ft. × 20 ft. in 1906. It has a south-eastern aspect, and is nowhere steep nor flat. It has received a fair amount of manure and cultivation, and is well grown. Thinning out was commenced in 1911, and has proceeded steadily ever since, until, at the time of the census, December 1920, it contains only 80 trees per acre.

"The figures are as follows :—

(1)	Trees yielding latex into the cups..	1428	28%	of total
(2)	Trees yielding scrap only ...	2605	50%	do
(3)	Trees not yielding anything ...	1078	20%	do
(4)	Trees not tapped (treated for brown bast on all three segments) ...	104	2%	do

"I have long been of the opinion that on many rubber estates 75% of the crop is obtained from 25% of the trees, and these figures bear me out. It would be of great interest to know the results of a census of the same field, and trees taken again, now with the object of finding out whether the same individual trees are bad yielders all the time, or only part of the time."

It is of interest to compare the figures obtained from a similar sort of census made at the Rubber Experiment Station, Mooply, during the months of November and December last year, over 1,266 trees.

These figures are as follows :—

(1)	Trees yielding scrap only	19·4%	of the total
(2)	Trees yielding up to ½ oz. of latex ...	29·6%	do
(3)	Trees yielding from ½ to 1 oz. of latex ...	26·8%	do
(4)	Trees yielding from 1 to 2 oz. of latex...	17·9%	do
(5)	Trees yielding from 2 to 3 oz. of latex...	4.1%	do
(6)	Trees yielding over 3 oz. of latex ...	2·2%	do

A census such as this provides valuable information when thinning out is to be done. In the field dealt with by my correspondent, the 2% of trees with brown bast and the 20% not yielding anything might be thinned out straight away without making any reduction in the crop, provided that none of them ever recover enough to be worth the money spent on them. They will make room for the better development of the remaining 78% which return some yield. When further thinning out becomes necessary, some of the 50% which yield scrap only can be removed.

In this case, however, the trees have already been thinned down to 80 to the acre, and the census emphasises the urgent need which exists for work to be done on seed selection and plant breeding, so as to endeavour to raise a strain of Trees which will be, among other things, better yielders. With the advent of the Rubber Mycologist, and the establishment of a really fine Mycological Station with some land attached to it, where such work can be carried out under the immediate and constant supervision of the officer in charge, it is hoped to make a start with some work of this sort. Preparations are also being made at the Rubber Experiment Station, Mooply, to do some seed selection work this year.—Planters' Chronicle, Vol. XVI. No. 24.

TAPPING EXPERIMENTS ON HEVEA BRASILIENSIS

DR. A. W. K. DE JONG.

(Summary.)

This experiment (for the results of the preceding 6½ years see this Archief IV p. 32), carried on for over 7 years, gave the following results: One left cut at 1·10 M. high on a quarter of the circumference, tapped twice daily; two left cuts 50 cm. apart on a quarter; two left cuts 50 cm. apart on a quarter; two left cuts 75 cm. apart on a third; and three left cuts 50 cm. apart, all tapped daily, have given almost the same yield. Of the trees with two cuts 50 cm. apart two have got brown bast disease and this is the reason this tapping system yielded less than the others after 6½ years of tapping.

The yield figures for the first $2\frac{1}{2}$ years, both for the trees which remained healthy throughout the experiment and for those which later developed the disease, show that there was no difference in the rubber producing ability. However, during the latter part of the experiment, the trees which afterwards became diseased yielded 20% more rubber than those which remained healthy.

This apparently supports the hypothesis, that the brown bast disease is caused by a too great loss of latex.

From these figures it is also seen that these tapping systems, which use the bark to a height of 1·60 M, have lost fewer trees than the tapping system in which the highest cut was placed at only 1·10 M.

Tapping a quarter, a third, or half the circumference of the tree with one left cut.

The following proportions of yields were founded :—

	$\frac{1}{4}$ of the C.	$\frac{1}{3}$ of the C.	$\frac{1}{2}$ of the C.
The first area	100	117	140
,, second area	100	116	135·5
,, third area	100	109·5	100
,, fourth area	100	87	82
and for the four areas tapped	100	105	109·5

—ARCHIEF VOOR DE RUBBERCULTUUR, June, 1921.

TAPPING TESTS AND BAST EXAMINATION OF HEVEA PLANTS FROM SELECTED SEED.

C. HEUSSER.

(Summary.)

In 1915 a seed plot for selected seed of *Hevea brasiliensis* was established on the Bijawak Estate. The seed sown was from the 1914 crop, the offspring of four vigorous and high yielding mother trees. In September 1918 one hundred daughter trees were selected as experimental trees : 34 offspring from mother tree No. I, 20 from No. II, 23 from No. III and 23 from No. IV. Up to September 1920 five tapping tests each of a month's duration were made, three determinations of latex vessel number and three determinations of stem girth and bark thickness one meter above the ground.

The five tapping tests (6 years old trees) show after calculation and elimination of all possible errors an increase (based on equal areas) of 16·8 per cent over the old plantings. Based on calculations for individual trees the selected ones gave an increase of 75 per cent.

The offspring show great variation in production. The breeding value of mother-trees vary consideraly.

It seems desirable in selecting mother-trees, that vegetative vigour should go hand-in-hand with high production. This is especially recommended for unusual soils.

The correlation between number of latex vessels and production at the end of four years can be expressed by the coefficient of correlation C. 426. It is only after the fifth and sixth year that the value becomes C. 55$\pm$ agreeing with Bobilioff, La Rue and Rijks work with older plants.

Thinning out trees based on the number of latex vessels does not yield satisfactory results—that is especially true in younger plantings. Thinning out trees on the basis of tapping tests and production measurements is preferable.

It is possible to simplify production measurements during tapping tests.—ARCHIEF VOOR DE RUBBERCULTUUR, June, 1921.

COFFEE

COFFEE UNDER SHADE

By "PLANTER"

Coffee is so universally grown under shade in Southern India now-a days that to the young planter it must appear to have been always so, and yet it is within the memory of many planters now living that coffee in every district except Mysore was grown completely in the open ; and, as has been pointed out in a former article, MR. DONALD STEWART, who earned the title of the "Coffee King" owing to the large number of properties he owned in Coorg, was particularly opposed to it. He in common with many other planters, who showed the greatest unwillingness to recognise the advantages of shade, and regarded the idea of taking instruction from Indian planters, whose gardens were always under shade, with the utmost contempt might have been guided by the fact that the plants, as is pointed out by the planting author, Hull, appear to effect shade universally in a state of nature, never being found growing wild except under the protection of its parent trees or in the depths of the forest, although the seeds are commonly deposited by wild animals and birds in open land. These planters followed their misguided course till they experienced a rude awakening. The conditions obtaining on unshaded estates, especially in districts subjected to prolonged periods of drought, particularly encouraged the multiplication of borer to an unlimited extent, and it is related of one place in particular, the property of MR. D. STEWART, that after giving a phenomenal crop of 125 tons off 250 acres in its fourth or fifth year, practically every tree in it was riddled with borer, thus necessitating its being completely replanted. Fortunately, the large profit produced by the place facilitated this being done; but in cases where the capital was not forthcoming, it led to the inevitable abandonment of places ; and thus the large number of abandoned properties in the comparatively early days of coffee planting is to be accounted for.

The advantage of growing coffee under shade may be summed up (as put by old writer) as diminished exhaustion, and consequently increased longevity of the plant, reduced cost of cultivation, a conservation of the nutritious properties of the soil, and an actual increase of these properties by the continuous fall of decaying leaves adding organic matter to it. As these have originally been formed to a considerable extent from constituents furnished by the sub-soil (provided the shade tree be a sub-soil feeder) there is a positive gain of matter to the surface which the roots of the coffee would otherwise never have been able to come within reach of. In addition, as is also pointed out, the value of estates growing large quantities of useful timber is being permanently increased, it being clear that a time must arrive when, owing to the constant progress of forest clearing, timber, whether for fuel, building purposes, or cabinet making, will become considerably more scarce and valuable than at present. Against these advantages, the sole drawback of shade for coffee is a diminished yield. The exact falling off will depend on

the density of the shade and the heat of the climate. While, however, coffee grown in the open would crop more largely the trees will the sooner be "pumped out," the coffee under shade will discover no signs of exhaustion, but be ready to go on bearing a crop of 3 or 4 cwt, per acre every year indefinitely. This is about the yield of old shaded estates in Mysore and Coorg at present ; but it pays.

It is half a century since the importance of shade for coffee was recognised in Coorg but the practice in favour there is to make a complete clearance of all forest trees and grow the shade with the coffee, planting the former at the same time as the latter, it being claimed that under this method the most suitable trees can be selected for shading the coffee. But as the land is subjected to a severe burn, which tends to the destruction of much organic matter and the latter is not added to till the shade tree grew up sufficiently, whereas if forest trees were left to shade the coffee it would be added to from the beginning, the practice is not to be commended. Certain jungle trees prove detrimental to the growth of coffee. These might be eliminated at once by cutting them down and stripping the bark off the stumps and replacing them by artificial shade. If it is desired to eventually eliminate all the old forest trees, this can be done by planting out artificial shade under the forest shade, and after the former has made sufficient growth, to gradually "ring" the forest trees by cutting a deep groove round the foot of their stems. Some damage results to the coffee when the trees fall, but this is soon repaired by stumping the trees and growing up suckers, which make bonny bushes within two seasons.

It was not till 1875 that shade for coffee was introduced into the Wynaad District. A fair correspondent writing to the MADRAS MAIL on the 5th of August in that year, says that the importance of shade for coffee had begun to force itself on the attention of planters sometime before then, and it was expected to effect wonders. There were to be no more weeds, no borer, no leaf disease—a sort of a planter's paradise in fact. Though all these benefits have not been realized, yet "there can be no question" as a writer in 1906 in the same paper quoting the lady correspondent observes, "that without shade the estates would have fared much worse than they have."

In the great majority of places the mistake has been made of planting the shade trees too closely together and instead of eliminating the superfluous trees as they grew into one another, of lopping off their lateral branches, thus reducing their spread and leaving a vastly larger number of boles encumbering the ground than was necessary and the land permeated with an undue mass of roots. The great desideratum is to have as few stems on the land as possible.

The credit belongs to the late MR. R. H. ELLIOTT, the well-known Mysore planter, of having reduced the growing of shade for coffee to a science. He has treated the subject very exhaustively in his book GOLD SPORT AND COFFEE PLANTING IN MYSORE ; and because of the one chapter it contains on shade for coffee it for nothing else—and it contains a lot of valuable information on the cultivation of coffee and on other matters—it deserves a place in every coffee planters' library.

Trees of the ficus tribe were held in great repute as suitable shade for coffee, but they are discredited in South Coorg now-a-days; yet coffee thrives under them. The great rule to observe in connection with shade trees is that if the coffee is doing well, not to interfere. The objection to the ficus species is that unless there is a good depth of soil their roots mostly permeate the surface, and thus deprive the coffee of nourishment; but this seems to be more than compensated for by the heavy mulch they supply the soil with, because, as has been pointed out above, coffee thrives under them. The only tree that is deep-rooted, and draws its nourishment mostly from the sub-soil is the jak (*Artocarpus integrifolia*), which is admirably suited for all aspects except the cool humid northern slopes. Some other trees that are held in high favour as shade are the "Ceylon Oak" (*Schieichera trijuga*), *Dalbergia latifolia* and *Terminalia beberica*. These three are best suited for southern and eastern slopes. *Albizzia stipulata and Albizzia odoratissima* as they do a light shade, would appropriately find a place on northern aspects. The silver oak has also come into favour as a permanent shade. It grows rapidly and affords a heavy leaf deposit. As the shape of the trees is pyramidical and they have not much of a spread, and in consequence cast a long lateral shade, they are best planted in avenues from East to West on Southern aspects, 15 feet apart in the avenues and 20 to 25 feet between them. It is worthy of note that trees which are deciduous in the cold weather are no protection against borer, as it is during this period of the year that the insects' eggs are hatched.

To MR. NELSON, late of Shencottah in Travancore, belongs the credit of having introduced *Erythrina lithosperma*. He claimed that coffee cultivated under them and mulched with their cuttings and leaves, which are said to contain 2·77 per cent. of nitrogen and 2·79 per cent. of potash, would yield largely, without manure of any other description being necessary. This was corroborated by the late MR. J. D'VAZ, a well-known Coorg planter. Writing to the MADRAS MAIL he said that it keeps coffee free of leaf disease and enables it to bear an even crop though manures of no other kind had been applied for a number of years. MR. HERBERT WRIGHT, late of Ceylon recommended the growing of *E. lithosperma* as a green manure; but MR. NELSON recommended it as a permanent shade, and the lopping of the trees in July—August to provide a heavy soil mulch. Fortunately the trees lend themselves to severe cutting, and shoot out with vigour again and afford shade for the coffee during the sunny months. But though the tree has been largely grown planters generally do not place much faith in the claims made on its behalf, and very little mulching is done with it, and certainly there is no diminution in the use of manures. —INDIAN SCIENTIFIC AGRICULTURIST, Vol. 2, No. 6.

OIL PALM.

CROP RECORDS OF OIL PALMS.

Writing in the "Communications of the General Experimental Station of the A.V.R.O.S." General Series No. 8, 1920, Dr. A. A. L. Rutgers contributes an account of the methods employed in Sumatra in the cultivation of the oil palm (*Elaeis guineensis*) with crop records of a number of palms under investigation in various districts in that country.

INTRODUCTION.

The area planted with oil palms on the east coast of Sumatra is increasing rapidly. Recent statistics are not available but it is estimated that at the commencement of 1920 about 15,000 acres were under cultivation, of which 5,000 acres were planted during the previous year. It is anticipated that the total area under this crop will be extended to 100,000 acres within the next ten years. When this area comes into bearing a yield of nearly 100,000 tons of oil per annum may be expected. The importance of this figure is shown by comparison with the total export from West Africa before the war, which has been calculated as 125,000 tons of palm oil and 325,000 tons of kernels.

DESCRIPTION OF THE PALMS UNDER OBSERVATION.

The crop records have been compiled from groups of palms on different estates, usually from ten to thirty palms from each group have been taken for observation. The fruit of these palms have been harvested separately by the staff of the Experimental Station once or twice a month. Each bunch collected has been weighed and the fruits extracted and weighed separately. From certain groups the weight of the fruits, stones and kernels have been recorded to obtain the percentage of pericarp and kernels. As a rule the small fruits without kernels, which in some cases form a considerable proportion of the bunch, have been neglected. The figures obtained are therefore conservative.

The records for three estates (Marihat, Piassa Oeloe, and Tanah Itam Oeloe) have been collected by the estate managers without the assistance of the Experimental Station.

The palms under observation are situated as follows :—

Ornamental Palms at St. Cyr.—Height above sea-level 282 feet. Some of the oldest palms on the east coast of Sumatra. These were planted during 1884, 1898, 1903 and 1911, on both sides of a road to the Manager's Bungalow. The palms are planted 14¾ feet and 16½ feet in rows and are partly shaded by large Ficus trees, Observations have been made during 1918 only.

Mata Pao Estate.—Height above sea-level 33 feet. The records have been taken from two rows of 20 palms, planted in 1913, at a distance of 33 feet by 33 feet apart, with coffee as a catch-crop. The palms Nos. 1 to 20 have been pruned as usual on the estate, the leaves being cut as soon as the fruits commence to grow. Palms numbering 21 to 40 have been pruned less severely.

Poeloe Radja Estate.—Height above sea-level 164 feet. The records have been collected from two rows of palms, planted in 1902, at a distance of 29½ feet by 29½ feet apart, formerly with coffee as a catch-crop. Palms Nos. 1 to 20 and 21 to 40 have been treated in the same way as on Mata Pao Estate.

Bekalla Estate.—Height above sea-level 203 feet. Palms Nos. 1 to 14, planted in 1898, may be considered as plantation palms, their conditions being as favourable as on a regular plantation. Palms Nos. 1 to 10 of the second series are counted as ornamental palms and were planted in 1888.

Marihat Baris Estate.—Height above sea-level 1,148 feet. Crop records are given from 139 ornamental palms planted 26¼ feet by 26¼ feet during 1914 on both sides of a road between coffee and rubber.

Piassa Oeloe Estate.—Height above sea-level 295 feet. Records are given for 1918 only from 281 plantation palms, planted 39⅓ feet by 39⅓ feet during 1912 and 1913.

Tanah Itam Oeloe Estate.—Height above sea-level 164 feet. Records were kept from 766 trees, planted 32¾ feet by 32¾ feet in January, 1915.

CULTIVATION.

Soils.—The oil palm is found bordering the West African coast from Senegal to the Congo, a region 2,485 miles long and 30 to 620 miles deep. It would appear that this vast area must contain soils of varying types. It is probable therefore that the oil palm is not restricted to special soils, its present distribution in Africa being not limited by soil conditions but by climatological factors. A rainfall of 40 inches appears to be the minimum. Little information is available regarding the types of land most suitable for the growth of *Elaeis* but the conclusions drawn by Chevalier and Hubert and confirmed by the experience obtained on the east coast of Sumatra are that the oil palm will grow in a variety of soils providing they are not swampy and gives the best results on rich soil, not too heavy.

Height above Sea-level.—In Africa the oil palm is not restricted to the coast, but has been found at an altitude of 3,937 feet and even 4,757 feet. On the east coast of Sumatra, oil palms, at 1,148 feet above sea-level are yielding the same crops as those on the plains.

Planting Distances.—The majority of the oil palms in Sumatra have been planted 32·8 feet by 32·8 feet or 29·5 feet by 29·5 feet. The author is of opinion that even 29·5 feet by 29·5 feet square is too wide. He advises 29·5 feet by 29·5 feet triangular or 26·2 feet by 26·2 feet square.

Diseases and Pests.—The oil palm is remarkably free from pests and diseases. The coconut beetles have not been recorded as damaging the stems of the palms in Sumatra.* The larvæ of several species of insects

* In this connection it is important to note that the Government Entomologist, F. M. S., considers the African oil palm as susceptible to the ravages of the red weevil *Rhynchophorus ferrugineus* as the coconut palm.

During May, 1920, an African Oil palm on the Experimental Plantation at Kuala Lumpur fell for no apparent reason, and upon examination was found to contain grubs of the red weevil. An adjoining palm possessing an unhealthy appearance was felled and found to be similarly attacked. The Government Entomologist further reports that in December, 1920, while making an inspection of some palms on the Experimental Plantation, two red weevils were observed on a palm attempting to force their rostrums into cracks on the trunk. Keeping them under observation, two more weevils were seen and one of these resting on the cut surface of a petiole was noticed to force its snout into it, turn round and, after several unsuccessful attempts, lay an egg. It might be mentioned that although the leaves of this palm had been cut away a week previously, the fermenting sap still attracted the weevils and the cut surface was in a condition suitable for the deposition of eggs.

It is therefore evident that when stem pruning is found necessary, precautions must be taken to prevent the weevils from laying their eggs through the cut surfaces.

(*Psychidæ and Limacodidæ*) have been observed feeding on the palms and will probably become more serious when larger areas have been planted.

Germination of the Seeds.—Oil palm seeds germinate very slowly, in some cases germination taking place in three months but more often taking nine months, while seeds imported from Africa as a rule do not germinate within twelve months.

The Agriculturist of the Experimental Station, MR. MAAS, commenced an extensive series of experiments to determine the factors influencing germination and the measures to be adopted to promote acceleration. A report on these experiments, which is not yet complete, will be published in due course. Some preliminary results are however available.

The experience gained at the Experimental Station and at Buitenzorg both demonstrate that fresh seeds germinate more rapidly than old seeds.

Several facts indicate that heat assists germination. Seeds immersed in hot water or fermented germinate earlier than control seeds; this has been proved to be the case both at the Experimental Station and on estates in Sumatra and also in Africa. It appears that the seeds are able to stand a considerable temperature, as high as 50° centigrade being found unharmful. No success has been obtained by cracking or filing the nuts.

Pruning.—Pruning is commonly practised on the east coast of Sumatra. As a rule the lowest leaves are cut away near the stem as soon as the bunch of fruit resting on the leaf has been pollinated and the fruits commence to grow. Should this method be practised severely, it appears likely that the palm will suffer; its leaves being forced into development too early causing the stem to grow to a greater height than normally. The results published by BUCHER and FICKENDEY show that the oil palms on the east coast of Sumatra form a tall stem more quickly than in Africa.

To obtain information on the influence of pruning on production the Experimental Station commenced two experiments. On Mata Pao Estate three plots of thirty palms and in Poeloe Radja Estate two rows of twenty palms were pruned in different ways and the fruits of these palms harvested separately. As the crop records cover only a period of six months it is not yet possible to draw conclusions. The results, however, so far obtained are contradictory as on Mata Pao Estate the highest production is obtained from the severely pruned palms while on Poeloe Radja Estate the heaviest yield is recorded from palms pruned less than usual. The following tables give the figures obtained:

Production of Pruned Oil Palms from Mata Pao Estate over a Period of six Months, in Lbs.

Month	Group II Pruned less than usual No. 21-40, 51-60		Group I Pruned as usual No. 1-20, 41-50		Group III Severely pruned No. 61-90	
	Bunches	Fruits	Bunches	Fruits	Bunches	Fruits.
October, 1919 -	253·3	86·7	166·9	49·2	139·6	67·1
November -	118·4	38·4	82·9	13·2	50·5	5·9
December -	143·8	56·4	43·9	8·9	205·9	107·4
January, 1920 -	37·7	17·8	119·5	66·9	133·2	59·7
February -	74·5	22·4	155·0	78·3	83·6	25·2
March -	267·7	124·6	378·1	157·3	346·1	142·7
Total...	895·4	346·3	946·3	373·8	958·9	408·0
Percentage	100	100	106	108	107	118

Production from Pruned Oil Palms from Poeloe Radja Estate over a Period of Six Months, in Lbs.

Month	Group I Pruned as usual, No. 1-20		Group II Pruned less than usual, No. 21-40	
	Bunches	Fruits	Bunches	Fruits
October, 1919 -	325·8	72·5	231·6	45·4
November -	548·4	143·5	440·4	153·3
December -	465·2	110·7	469·2	119·1
January, 1920 -	326·4	106·3	524·6	185·9
February -	474·5	175·9	581·7	237·8
March -	496·1	147 2	392·9	151·0
Total...	2,636·4	756·1	2,640·4	892·5
Percentage	100	85	100	100

The general opinion is that the largest bunches are obtained by removing the leaves as soon as the fruits commence to grow ; this conclusion has so far not been contradicted by experiment.

Pollination.—It is obvious that the natural pollination of oil palms is far from satisfactory and is indicated by the low percentage of fruits on the bunches. When pollination has been effective, the fruits form 50 per cent or more of the weight of the bunch whereas where poor pollination has taken place the percentage may drop to 25 per cent. or even lower.

Probably, one of the factors determining the crop is the fertility of the soil, but pollination is certainly another important factor and this is confirmed by the results obtained by MR. SCHADT on Tanah Itam Oeloe Estate, As pollination is easily done by hand it appears probable that artificial pollination will become a regular undertaking in estate practice. Certain observations tend to show that there is a relationship between the number of insects visiting the oil palms during flowering and the number of fruits that mature.

Distribution of the Crop over the year.—Usually, the production of fruit is lowest during the first and last months of the year. On Mata Pao Estate this is definitely the case, the best four months being May to August, giving a yield of 201 bunches against a minimum of 60 bunches during the four months, November to February. On Tana Itam Oeloe Estate, a yield of 188 bunches against 79 is recorded, while on Poeloe Radja the proportion is 118 bunches to 51. On Bekalla, St. Cyr and Marihat Estates the distribution is even throughout the year. It is a well known fact that dry weather is unfavourable to the production of fruit ; and in the dry regions of Africa the factories close down for several months of the year, It therefore appears probable that rainfall has much to do with the variability of production during the year, The following figures obtained during 1919 show the distribution of the crop over the year on a number of estates but do not as yet lead to conclusive results.

Distribution of the Crop over the Year. Number of Bunches per Month.

Month	Mata Pao*		Poeloe Radja		Bekalla		St. Cyr.	
	1918	1919	1918	1919	1918	1919	1918	1919
January -	6	13	—	5	—	14	17	—
February -	5	22	—	10	—	15	13	—
March -	9	18	—	9	—	18	7	—
April -	30	37	—	27	—	23	6	—
May -	36	58	—	21	—	23	10	—
June -	40	40	—	23	—	22	13	—
July -	34	51	—	34	—	12	7	—
August -	26	52	22	32	20	11	21	—
September -	24	38	28	29	22	11	14	—
October -	17	20	28	14	19	15	17	—
November -	9	20	11	22	11	18	23	—
December -	7	5	9	27	17	13	16	—

Distribution of the Crop over the Year. Number of Bunches per Month.—(*Contd.*)

Month	Marihat		Piassa Oeloe		Tanah Itam Oeloe.†	
	1918	1919	1918	1919	1918	1919
January -	150	88	—	331	3	9
February -	130	93	—	326	7	11
March -	157	100	—	419	8	32
April -	171	92	—	—	8	31
May -	169	107	—	—	18	18
June -	174	121	—	—	17	59
July -	204	152	—	—	11	48
August -	138	87	—	—	15	27
September -	49	100	—	—	15	54
October -	135	118	279	—	15	41
November -	124	91	432	—	13	27
December -	120	108	361	—	16	32

Age at which Palms come into Bearing.—Available facts have been too scanty to allow of definite conclusions being given in previous publications. The figures from Tanah Itam Oeloe Estate, given in this paper, show that in certain cases, a crop may be expected in the fourth year. A block of 16·9 acres, on that estate, produced in the fourth year, 41·89 lb. of fruit per palm and in the fifth year 112·45 lb. Certain palms at the Experimental Station came into bearing when only two years old.

CROP RECORDS 1918 AND 1919.

The basis for calculating the yields of the palms under investigation is the production per palm per annum. Therefore, three series of figures have been recorded :

(a) Production of bunches and fruit
(b) Percentage of pericarp, nuts and kernels in the fruit
(c) Percentage of oil in the pericarp and the kernels

* Mata Pao Estate in 1918 from 20 palms, in 1919 from 40 palms.
† Tanah Itam Oeloe Estate weight of fruit is 100 kilograms.

The first two points have been investigated by the author and the third by IR. VAN HEURN, who published his results in 1919.* A compilation of the results obtained in 1918 and 1919 as to the production of bunches and fruit by the palms under observation is given in Table I. These figures compare favourably with those recorded from Africa. Averaging the figures of ADAM, CHEVALIER and HUBERT, the following figures are obtained; number of bunches 6·4 weight per bunch 13·23 lb. total weight of bunches 84·67 lb. total weight fruits 59·53 lb.

TABLE I.

Crop per Palm per Annum in Lbs.

Estate	Planted	Year	Number of bunches	Weight per bunch	Total weight, bunches	Total weight, fruits
Mata Pao	1913	1918	12·1	6·61	79·38	30·87
		1919	9·2	10·80	101·43	39·69
,,	1913	1918	—	—	—	—
		1919	9·5	12·12	114·66	50·71 †
Poeloe Radja	1912	1918	11·3	14·11	158·76	50·71
		1919	14·5	14·77	213·88	46·30 ‡
,, ,,	1912	1918	—	—	—	—
		1919	12·6	16·53	297·27	52·92 †
Bekalla	1898	1918	11·0	34·17	357·21	145·53
		1919	9·6	35·72	341·77	123·48
Ornamental palms Bekalla	1888	1918	5·2	29·54	154·35	70·56
		1919	6·0	30·20	180·81	70·56
,, St. Cyr H	1911	1918	2·4	9·92	24·25	11·02
		1919	—	—	—	—
,, ,, E	1903	1918	6·8	41·01	280·03	136·71
		1919	—	—	—	—
,, ,, B	1898	1918	4·9	56·44	275·62	149·94
		1919	—	—	—	—
,, ,, A	1884	1918	2·5	47·84	121·27	66·15
		1919	—	—	...	—
,, Marihat Baris	1913	1918	12·4	12·34	154·35	92·61
		1919	9·0	15·65	141·12	99·22
Piassa Oeloe	1912	1918	15·3	14·99	233·73	116·86
		1919	—	—	—	—
Tanah Itam Oeloe	1914	1918	—	—	—	41·89
		1919	—	—	—	112·45

The figures in Table I show considerable variation and it is therefore a matter of some difficulty to estimate an average crop. In Table II, the estimate published in 1919 is reproduced but in all probability it may be considered too low for the young palms and perhaps too high for those in full bearing.

* IR. JHR. VAN HEURN. *Vetbepalingen bij oliepalmvruchten Mededeelingen van the Algemeen Proefstation der A.V.R.O.S.* Algemeene Serie No, 6, 1919, Published in Dutch only.

† These palms have been pruned less than usual.

‡ The percentage of fruits in the bunches is very low on Poeloe Radja Estate. Probably, pollination is deficient.

TABLE II.
Estimated Average Crop Per Palm in lbs. full Bearing.

	Number of bunches	Weight per bunch	Total weight, bunches	Total weight, fruits
5th-10th year -	12	13	158	53
11th-30th year -	10	33	330	165
31st-50th year -	3	44	132	66

The second point under investigation is the percentage of fruits pericarp, nuts and kernels in the bunches. The weight of the fruits has been taken as a basis for calculating the percentage. In Table III which gives the results for 1918 and 1919, the weight of the fruit is therefore placed at 100 and shows that the fruits contain 60 per cent. pericarp and 8 per cent. kernels.

TABLE III.
Weight of Bunches, Pericarp, Nuts and Kernels, in per cent. of the Fruit

Estate	Planted	Year	Bunches	Fruits	Pericarp per cent.	Nuts per cent.	Kernels per cent.
Mata Pao .	1913	1918	270	100	60	40	7
		1919	250	100	56	44	9
,, -	,,	1918	—	—	—	—	—
		1919	240	100	61	39	8
Poeloe Radja -	1912	1918	310	100	63	37	7
		1919	450	100	—	—	—
,, -	,,	1918	—	—	—	—	—
		1919	390	100	—	—	—
Bekalla -	1898	1918	255	100	65	35	8
		1919	280	100	62	38	8
,, ornamental palms	1888	1918	215	100	62	38	9
		1919	210	100	55	45	12
St. Cyr. H. ,, -	1911	1918	200	100	64	36	8
		1919	—	—	—	—	—
,, E. ,, -	1903	1918	220	100	65	35	7
		1919	—	—	—	—	—
,, B. ,, -	1898	1918	200	100	55	45	11
		1919	—	—	—	—	—
,, A. ,, -	1884	1918	280	100	63	37	8
		1919	—	—	—	—	—
Marihat Baris ,, -	1913	1918	165	100	50	50	—
		1919	141	100	50	50	—
Piassa Oeloe -	1912	1918	195	100	61	39	—
		1919	—	—	—	—	—
Tanah Itam Oeloe -	1914	1918	—	100	61	39	—
		1919	—	100	61	39	—

BASIS FOR CALCULATING PROBABLE YIELDS.

In Table IV an estimate is given of the yields that may be expected from this crop from the 5th to the 50th year. The figures must be considered as theoretical as calculated yields should always be accepted with some caution. Further the figures show the total amount of fat present and even the best machinery can only expect to extract 80 per cent. of palm oil and 100 per cent. of the kernels. It is therefore probable that these figures are somewhat high but against this the normal fruits only have been weighed at the Experimental Station and the smaller fruits without kernels thrown away. The latter contain a considerable amount of fat which might be readily extracted by efficient machinery.

The estimated yields of fruits and oil from an acre of oil palms planted 26 feet by 26 feet—i.e., at sixty-four palms to the acre, work out as follows :—

ESTIMATED YIELDS.

Production Per Acre Per Year in Tons Planted 26 by 26 ft.

	Number of bunches	Weight of bunches	Weight of fruits	Weight of Pericarp	Weight of palm oil	Weight of kernels
5th-10th year -	768	4·51	1·51	0·906	0·498	0·121
11th-30th year -	640	9·44	4·72	2·826	1·554	0·377
31st-50th year -	192	3·77	1·89	1·134	0·624	0·151

J. N. M.—Agric. Bull. of F.M.S., Vol. VIII, No. 4

ZANZIBAR CLOVES.

The Indian and Eastern Druggist, Vol. II, No. 7 has an article on Zanzibar Cloves taken from the Colonial Report for Zanzibar for the year 1919, and the following extract taken from it will show the importance of this crop in that country :—

In 1872, the plantations in Zanzibar were devastated by a hurricane and consequently most of the trees in the island date from that time. Pemba, however, escaped, and the large plantations there, are, therefore, much older, varying from 60 to 90 years. It is estimated that there are in both the islands about 52,000 acres under clove cultivation, and about 4,700,000 trees in bearing. The output varies considerably, the trees bearing heavy crops periodically every three to five years. The average output of recent years has been about 14,000,000 lb. The largest crop on record is that of the season 1918 19, which yielded nearly 29,000,000 lb. The smallest crop recorded in recent years was in the season 1912-13, when only 4,750,000 lb. were harvested, of which Pemba contributed more than 3,500,000 lb. The average yield per annum from a plantation of about 3,000 trees of about 60 years old, owned and managed by Europeans, is 8 lb. per tree. Ninety-eight trees are planted to the acre. The price varies according to the size of the crop. Marked fluctuations are due to outside causes. The price of recent years has varied from Rs. 8-8-0 to Rs. 45-9-0 per frasila (35 lb). The Government levies a local tax of 25 per cent on all cloves exported. For the season 1918-19 (July 1, 1918 to June 30, 1919), deliveries from Zanzibar were 9,074,528 lb. and from Pemba 19,783,018 lb. Deliveries for the first part of the 1919-20 season were, from Zanzibar, 2,902,712 lb., and from Pemba, 5,203,676 lb.

CEYLON AGRICULTURE

CEYLON AGRICULTURAL SOCIETY.

MEETING OF JULY 6th, 1921.

A meeting of the Ceylon Agricultural Society was held at the Council Chamber, Colombo, at 12 noon, on Wednesday, the 6th July.

His Excellency the Governor presided; and there were also present the Honorables The Director of Agriculture, Meedeniya Adigar, Dr. H. M. Fernando, Balasingham, Tillekeratne, H. L. De Mel, Jas. Peiries, Abdul Cader, E. R. Tambimuttu, and Kotalawala; Lt. Col. T. G. Jayawardene, Dr. Hewavitarne; Mudaliyars A. E. Rajapakse, C. H. Samarakkody, J. A. Weerasinha and L. H. Dassanaike; Messrs. A. W. Beven, K. Bandara Beddewela, C. Drieberg, F. L. Daniel, W. A. de Silva, J. S. de Silva, and M. Kelway Bamber (Secretary).

Before the Agenda was taken up the Director of Agriculture referred to the tragic death of MR. FRANCIS BEVEN, who had been a member of the Society since its inception and who always took a keen interest in agriculture. The Director moved a vote of condolence with the family of MR. BEVEN in their sad bereavement. Seconded by MR. TILLEKERATNE, the motion was carried, the members standing.

The Director next mentioned that MR. A. W. BEVEN who was nominated by the Society to serve on the Food Products Committee of the Board of Agriculture, desired to resign and nominate MUDALIYAR RAJAPAKSE. The resignation was accepted and MR. RAJAPAKSE was appointed accordingly.

The minutes of the previous meeting held on 2nd February, 1921, were read and confirmed.

The Secretary read the Progress Report on which MR. TILLEKERATNE offered remarks. The Director in reply said that a new Agricultural Instructor would be appointed to Hambantota district. Anuradhapura had no Agricultural Instructor at present because questions affecting the North-Central Province were dealt with by the Agricultural Staff stationed at Anuradhapura. However, an officer will be appointed after consultation with the Govt. Agent, if he thinks it desirable to have an Instructor to assist villagers. He did not think it advisable to start a discussion on the question of Chenas that day. The Matara Agricultural Instructor was of opinion that restriction of chena licenses was likely to lead to a wider cultivation of paddy. The question of compensation for damage done by floods was a very wide one and he would not like to pledge himself on the subject at that meeting.

The report was adopted.

The statement of receipts and expenditure to end of June, 1921, and audited statement of accounts for 1920 were submitted and passed. The Director remarked there was still some Rs. 825 arrears due by local members which the Secretary would be glad to receive as soon as convenient.

The Secretary read the report of the Special Sub-Committee appointed to consider the future relationship between the Department of Agriculture, the Board of Agriculture and the Agricultural Society. MR. DANIEL, MR. TILLEKERATNE, DR. FERNANDO and MR JAMES PEIRIES offered remarks. After some explanations by the Director on points raised, the report was adopted.

MR. A. W. BEVEN's paper on "Coconut Cultivation 1881-1921" was read by the Secretary, MR. BEVEN though present not being well enough to do so. MR. DANIEL in the course of the discussion which followed enquired whether MR. BEVEN or the DIRECTOR could explain why village cultivators so extensively used props and why some estates had adopted the practice.

The DIRECTOR explained that some varieties of coconut palms had weak leaf-stalks and if the leaves were not propped, the weight of the bunches of nuts either caused a complete fracture between the leaf and the trunk or a fracture of the leaf itself. The object was to retain the leaves on the trees for as long a period as possible. This was the only explanation he could give of the custom. It would be interesting to ascertain which varieties had weak stems and which had strong leaf stems. DR. FERNANDO thought it was not so much a case of species as of climate. In wet districts petioles were generally weaker than in dry areas.

On the motion of MR. DRIEBERG seconded by DR. FERNANDO a hearty vote of thanks was accorded MR. BEVEN for his interesting paper.

With a vote of thanks by MR. TILLEKERATNE to HIS EXCELLENCY for presiding, seconded by the SECRETARY the proceedings closed.

ESTATE PRODUCTS COMMITTEE.

Minutes of the Third Meeting of the Estate Products Committee of the Board of Agriculture held at the Experiment Station, Peradeniya, at 2-30 p.m., on Thursday, July 7th, 1921.

Present.—The Hon'ble the Director of Agriculture (Chairman), the Government Botanist and Mycologist, the Government Agricultural Chemist, the Government Entomologist, Messrs, G. Bryce (Assistant Botanist and Mycologist), F. P. Jepson (Assistant Entomologist), H. D. Garrick, J. Græme Sinclair, A J. Austin Dickson, John Horsfall, George Brown, W. R. Matthew, N. G. Campbell, J. B. Coles, F. R. Dakeyne, C. E. A. Dias, J. P. Blackmore, G. B. Foote, M. L. Wilkins, Hon'ble Mr. James Peiris, Dr. C. A. Hewayitarne, Lt.-Col. T. G Jayawardene, Gate Mudaliyar A. E. Rajapakse, Hon'ble Mr. O. C. Tillekeratne, Messrs. N. D. S. Silva, F. R. Senanayake, L. H. S. Peiris and T. H. Holland (Secretary).

Visitors.—Lt.-Col. W. G. B. Dickson, Messrs. G. W. F. Soysa, J. Malcomson, C. C. Durrant, S. Sedgwick, C. H. Gadd and R. C. Haworth Price.

Letters and telegrams of regret of inability to attend were received from the Government Agent, C.P., the Government Agent, N.P., Major J. W. Oldfield, Messrs. W. A. de Silva, W. Coombe, D. S. Cameron, A. W. Beven and Hon'ble Mr. H. L. De Mel.

The minutes of the previous meeting were taken as read.

The CHAIRMAN announced the nomination by the Low-Country Products Association of MR. L. H. S. PEIRIS as a member in place of MR. C. P. DE SILVA.

Agenda Item 1 Progress Report of the Experiment Station, Peradeniya.

This had been circulated to members and was briefly reviewed by the Chairman.

In reply to a question by MR. GARRICK regarding the swarm of locusts present in the Cacao, the Government Entomologist stated that it was hard to deal with these insects in the adult stage since they remained mostly in high trees. They were more easily dealt with during October and November when they descended to the ground to lay their eggs.

DR. HEWAVITARNE said he had seen considerable defoliation of trees by locusts on one occasion in the Southern Province.

The CHAIRMAN mentioned an attack on Arecanut Palms by locusts in the Kegalle district.

MR. J. P. BLACKMORE enquired if locusts had been found to damage Cacao pods.

The CHAIRMAN replied in the negative and added that on the Experiment Station the locusts preferred Dadaps to Cacao leaves.

Agenda Item 2—Tractor Trials, 1921.

The report of the Judges of the trials held on Clovis Estate, Kurunegala, on June 17th and 18th was placed on the table and reviewed by the CHAIRMAN. A number of photographs of the trials were also shown.

The CHAIRMAN extended his thanks to the Directors of the Ceylon Coconut Co., Ltd., for kindly placing the land at the disposal of the Department, and to the judges for the painstaking manner in which they had performed their duties. He wished especially to thank MR. C. E. A. DIAS for his hospitality during the two days of the trials.

The CHAIRMAN then presented the gold medal to MR. SEDGWICK, Agent in Ceylon for the Cletrac Tractors.

MR. SEDGWICK in replying dwelt on the great benefit conferred on Agriculture by official trials of this nature. He thanked the DIRECTOR OF AGRICULTURE for the great personal interest he had taken in the trials. He had been asked by a number of people whether the Cletrac was capable of being operated by a previously unskilled cooly ; he quoted an example of a tractor which had been operated for 5 months in the Chilaw district by an unskilled Sinhalese man. The Tractor had been dismantled at the end of 5 months and thoroughly overhauled by an expert who had found no trace of wear. This was an adequate answer to the question.

Agenda Item 3—Report on Government Entomologist's Visit to Batticaloa.

DR. HUTSON read his report which was concerned with the damage done by the Black-headed caterpillar, the Rhinoceros or Black Beetle and the Red weevil in the Batticaloa coconut area and the necessary measures for their prevention and destruction.

GATE MUDALIYAR RAJAPAKSE enquired why these pests were especially prevalent in the Batticaloa district.

The CHAIRMAN replied that a large number of trees had been blown down by the recent Cyclone. The broken stumps and debris had not been cleared up sufficiently quickly with the result that a large number of breeding places for beetles had been left. The matter had been referred to the Plant Pest Board, Batticaloa. The main point to be emphasised was the necessity for effectually dealing with stumps.

MR. DAKEYNE enquired whether either of the beetles had been known to attack rubber.

DR. HUTSON replied in the negative.

MR. J. P. BLACKMORE enquired if burning out old stumps with Saltpetre had been tried.

MR. PETCH replied that he had tried to burn an old mango stump in this way at Peradeniya, after 6 months the stump was still there.

MR. BRUCE FOOTE quoted a similar failure with a milla stump.

Agenda Item 4.—Report on Coconut Experiments on Alexandra Estate, Jaela.

These experiments had been carried out by MR. J. E. P. RAJAPAKSE who was unfortunately unable to be present.

The report was read by GATE MUDALIYAR A. E. RAJAPAKSE, who before commencing outlined the object of the experiments.

Some years ago when disc-harrows were first introduced into the Island, monthly disc-harrowing, after clearing all fallings from the ground, became very popular and gave apparently excellent results. This method prevented growth of any vegetation and if practiced without manuring seemed likely in time to impoverish the soil. It was to determine the value or otherwise of such methods that these experiments were started.

MUDALIYAR RAJAPAKSE then read the report. The experiments clearly showed that constant cultivation without manuring was a failure.

More time was required to determine whether intensive cultivation combined with manuring give better results than either by itself.

At the conclusion MUDALIYAR RAJAPAKSE showed the CHAIRMAN some remarks made in the Alexandra Estate visitors' book by two scientists from the Dutch East Indies.

Agenda Item 5.—The Cause of Rust and Mould on Smoked Rubber Sheets.

This subject was introduced by MR. C. E. A. DIAS who showed a number of specimen sheets and said that two or three weeks after altering the grooving of his sheets from Diamond to Spiral, mildew had appeared for the first time. No other change had been made nor was there any marked change in the temperature. Further some rubber which had been coagulated with a powder obtained from Germany showed no mildew while similar sheets for the coagulation of which Acetic Acid had been used were mildewed.

Sheets kept for a longer period than usual in the smoke house appeared to show signs of Rust. The CHAIRMAN asked Mr. PETCH for a brief statement on the causes of Rust and Mould.

MR. PETCH summarised the results of some experiments by HELLENDOOM in Java in 1917.

Rust appears in a fine powder when a sheet is stretched.

When rubber is coagulated part of the proteids are left in the serum and a small quantity in the coagulated rubber. If a film of this serum dries on the sheet the film may be attacked and decomposed by bacteria and rust will result. There should be no undue delay in rolling after coagulation. Since the organism which causes rust can only live in the presence of air, in cases where sheets are coagulated over night Rust may be diminished by sinking the coagulum with a block of wood. Keeping freshly rolled sheets in a damp atmosphere will increase rust. The sheets should be rapidly surface dried in a current of air and after dripping for a few hours should be taken to the smoke house.

Mr. Bruce Foote enquired if hot air could be harmful.

Mr. Petch was of the opinion that for a short time no harm could result. He did not think the use of hot water was advisable though it did disinfect the sheets.

On the subject of Mould Mr. Petch made the following remarks .—

Moulds would grow on any organic substances in the tropics in damp weather. It was generally merely a question of drying but the serum substances were hygroscopic and a sheet which contained more of these substances would absorb more moisture and be more liable to mould. Disinfection with 1% Formalin would kill any spores present but rapid drying after this treatment was essential. If the rubber became damp again fresh mould would appear. All the rubber shown at the 1906 Exhibition went mouldy within a month.

Mr. M. L. Wilkins confirmed Mr. Petch's remarks and emphasised the influence of climate. He knew of one estate where all the generally accepted rules were transgressed but which turned out excellent rubber. He attributed this to low rainfall and dry atmosphere.

Mr. J. P. Blackmore enquired what harm Rust did to the finished product.

It was stated that Rust in no manner deteriorated the quality of the rubber.

Agenda Item 6. The Possibilities of Manufacture and Sale of Rubber Articles on a Commercial Basis by Estates.

Mr. Dakeyne in introducing this subject said that the Kalutara Planters thought it a pity to destroy scrap wholesale. Useful articles could be made from it. He showed specimens of mats made on Vogan Estate. He asked Mr. Bamber's opinion.

Mr. Kelway Bamber said that he was engaged in a scheme to get the whole of the scrap off the market. By distillation a substance resembling Turpentine could be obtained which could be used in the production of paint at about $\frac{1}{3}$ of its present market price.

The residue after distillation could be utilised for the insulation of Cables, etc.

Earth scrap could, mixed with pitch, be used, for roads.

The road area which the P. W. D. were intending to tar would use up the whole of the available earth scrap.

Mr. Bruce Foote asked if it was possible to vulcanise rubber articles on an estate.

Mr. Bamber gave the details of a new method of vulcanisation which might possibly be used. He was of the opinion that articles made from unvulcanised crepe rubber kept quite well.

Agenda Item 7. Red Rust on Tea.

MR. GEO. BROWN asked the following questions :—

1. Are variegated leaves a sure sign of Red Rust ? Is there not some confusion between variegated leaves and yellow leaves which are generally a sure sign that the bush has been affected ?

2. Some twigs turn greyish white and die without exhibiting the typical red fructification. Is there some intermediate form of the Alga other than this red fructification ?

3. Is it the general opinion that hard pruning is beneficial for an infected field ? A hard pruned bush appears *less* able to throw off an attack than a lightly pruned bush. Seed bearers appear to throw it off easily.

4. Has it been noticed that the disease largely attacks branches that have been attacked by Shot-hole Borer ?

5. Has the effect of wood ashes from a factory upon the disease been noticed?

MR. PETCH replied :—Variegated leaves whether green and white or green and yellow are not an invariable sign of Red Rust. In Red Rust cases the yellow edges are usually more clearly defined. The disease spreads from leaf to stem but in dry weather the Alga may penetrate the stem and show no fructification on the outside for a year or more.

The disease has been known for 20 years in Ceylon and 40 years in India. In India light pruning is considered useless. Clean pruning is essential. Twigs are most liable to attack and must be removed.

After hard pruning the disease may come out on stems up to 2 inches or more in diameter and kill them. In this way greater damage would be done than on an unpruned bush. The remedy is spraying with Bordeaux mixture after pruning. Bushes should not be allowed to run up before pruning. No information is at present available on the relation between Red Rust and Shot-hole Borer.

With regard to wood ashes Potash manures are beneficial in that they promote the growth of strong healthy stems.

Work is being done and when certain facts are established it will be possible to issue a bulletin on the subject.

MR. GEO. BROWN asked if MR. PETCH had noticed that seed bearers threw off the disease easily and that the stems were not affected.

MR. PETCH replied that Red Rust being an Alga required light for its growth. The denser foliage of the seed bearers probably excluded the light from the stems.

DR. HEWAVITARNE detailed an instance on one of his properties where after manuring and light pruning the disease disappeared. He had tried liming on one occasion but without effect.

Agenda Item 8.

In view of the fact that Government has abandoned the policy of increasing food production in this country by means of legislation, to consider whether it is desirable that in the alienation of Crown lands for agricultural purposes in the future, provision should be made, that a definite proportion of each land so alienated be devoted entirely to the growing of Food Products.

The above motion had been proposed by HON'BLE DR. H. M. FERNANDO at the recent meeting of the Food Products Committee.

The CHAIRMAN said that owing to its wide scope he had placed the motion before the Estate Products Committee before taking any action. Government were desirous of encouraging Food Production in every possible

way. A bill had been drafted to enforce food production by all employers of labour but owing to adverse opinion had not been proceeded with. MUDALIYAR RAJAPAKSE asked the Chairman if it was possible on high lands to grow Food stuffs continuously.

The CHAIRMAN replied that it was, at a price

HON'BLE MR. JAMES PEIRIES thought that the condition should apply to low lands and deniyas only. On high lands food products were usually grown temporarily as catch crops but it was not possible to do so, permanently.

MR. DIAS mentioned an experience with Elvi. On new land he had obtained 25 bushels per acre, the following year with manuring he could not obtain 5 bushels.

MUDALIYAR RAJAPAKSE thought that the reservation should apply only to irrigable land.

MR. BRUCE FOOTE did not see how the distinction was to be made.

MR. NEILL CAMPBELL said that any one would be lucky to get one crop a year off the Nuwara Eliya Patnas.

MR. GARRICK was of the opinion that the machinery necessary to carry out such a measure would not be justified by the results.

MR. GRAEME SINCLAIR thought that such a serious matter could not be discussed off-hand. If an Ordinance was brought in it would presumably be submitted to all the bodies concerned.

The CHAIRMAN pointed out that no ordinance was contemplated but a condition in Crown leases.

MUDALIYAR RAJAPAKSE thought that it was a great pity that the Minneriya Development Co. had not carried on for longer.

MR. F. R. SENANAYAKE thought that land which would grow foodstuffs should be leased only for that purpose. If only a small proportion of land in the country was suitable for the growth of foodstuffs this land should be utilised for the purpose.

LT.-COL. T. G. JAYAWARDENE said the scheme would be an expensive one to enforce. He thought it should be confined to Paddy. The term foodstuffs was too vague.

After further discussion it was decided that the following motion proposed by MR. F. R. SENANAYAKE and seconded by MR. J. B. COLES should be sent to the Planters' Association and Low Country Products Association for their views and that DR. H. M. FERNANDO'S motion should be sent in addition :—

"In view of the fact that Government has abandoned the policy of increasing food production in this country by means of legislation, to consider whether it is desirable that in the alienation of Crown lands for agricultural purposes in the future, provision should be made to reserve the whole of the land suitable for paddy cultivation for that purpose."

Agenda Item 9.—Agricultural Publications.

A number of recent publications including Posters on Shot-hole Borer and Paddy Fly were laid on the table.

T. H. HOLLAND,
Secretary,
Estate Products Committee.

FOOD PRODUCTION COMMITTEES.

Minutes of the Kegalle Food Production Committee held at the Kegalle Kachcheri on 19th July, 1921.

Present:—The Assistant Government Agent (in the chair), Boyagoda, Mapitigama, Meedeniya and Dedigama Ratemahatmayas, Messrs. A. A. Wickremasingha, R. P. Seneviratne and A. F. Gunaratne (Hony. Secretary).

1. Minutes of the last meeting were read and confirmed.

2. It was resolved that printed notices be published in villages offering prizes for paddy cultivation and vegetable garden competitions as was done last year. That the prizes be Rs. 25 for first, and Rs. 15 for second in each competition, for each Ratemahatmaya's division. That the dates of judging be decided upon by the Judges who should be the Agricultural Instructor and Ratemahatmaya of each division, and that the prizes be given away by the Assistant Government Agent, with as much publicity as possible.

3. The question of establishing a co-operative smithy was discussed. It was resolved that the matter be left to private enterprise.

4. Consideration of the proposed New Irrigation rules was postponed for next meeting.

5. Committee considers that there will not be sufficient Mavi seed paddy for next year owing to the late cultivation and non-cultivation of fields for maha this year due to failure of rain.

6. The following new members were elected, viz.—Messrs. A. E. Ondaatje, K. B. Nugapitiya, Kanagasabai, R. P. P. Wirasuriya, M. G. Perera and B. J. Peiris.

CEYLON AGRICULTURAL SOCIETY.

PROGRESS REPORT No. LXXIX.

According to the decision arrived at, at the last meeting of the Society, held on 2nd February, the Special Sub-Committee then appointed submits its report to this meeting to-day. The recommendations regarding the future policy are detailed in that Report.

The Agricultural Instructors, Seed Distribution work and Agricultural Publications, formerly part of the operations of the Agricultural Society, will be absorbed into the Department of Agriculture and an "Agri.-Horticultural Society of Ceylon" will be organised with headquarters in Colombo. A fully organised Department of Agriculture will be developed and an independent Agri.-Horticultural Society organised. Ceylon at last is well on the way towards having a Department of Agriculture, which will be capable of handling the many and varied agricultural problems, and the economical advancement of the Colony can be entrusted to this Department.

MEMBERSHIP.

The membership of the Society has remained about normal, the present roll numbering 695 local members. It is matter for regret to have to mention that local subscriptions are not coming in as freely and quickly as they should.

It is desired that members who are still in arrears will remit their subscriptions promptly.

Subscribers to the TROPICAL AGRICULTURIST from abroad number 530. The total number on the roll is 1,347 including those receiving the Journal free in exchange.

The following is a list of members who joined during the period January, 1921, to date :—James Renton ; Dennis Wood ; Basil W. Selwyn ; D. E. Rodrigo ; H. W. R. Bertrand; F. C. Theobald ; Alfred A. Jayasinghe ; K. V. M Thiagaraja ; Gordon Skene ; A. G. Thompson ; C. Watkins Baker : Superintendent, Margaret Estate ; Superintendent, Mylagama Estate ; Tela Railroad Co., Honduras; Truxillo Railroad Co., Honduras ; Zamboanga Development Co., Philippine Islands ; African Lakes Corporation, Nyasaland ; Hawaii Board of Commissioners of Agriculture and Forestry ; Percy Lowle, Mozambique ; A. H. Hasim ; M. R. Johanneson, B. Borneo ; A. E. Collens, B. W. I. ; Victor M. Buck, West Africa ; Director of Botanical Survey of India, Calcutta.

STAFF.

It is gratifying to be able to report that as a result of the amalgamation of services in connection with the re-organization of the Department of Agriculture, the very loyal and ungrudging services of the Society's staff have come under due recognition of the Director who, as Organising Vice-President of the Society, had every opportunity of judging each individual officer's duties. His recommendations having deservedly received favourable consideration of Government, the various officers have been adequately provided for. These officers desire to have their gratitude to the Government and the Director recorded. Mr. J. S. de Silva, who was the first to join the Society's service as Chief Clerk, after a record of 17 years' service, will become the Manager of the Central Seed Store and Publications Assistant in the Department and will be assisted by some of the present office staff.

The Agricultural Instructors will go under the various Divisional Officers and will be distributed as follows:—

Central Division (under Mr. G. Harbord.)

1.	Mr. W. Molegode	Katugastota
2.	,, J. R. Nugewela	Matale
3.	,, C. P. Crispeyn	Kegalle
4.	,, V. G. Perera	Mahawela
5.	,, Walter Perera	Peradeniya
6.	,, C. W. Dangamuwa	Maswela
7.	,, M. B. Wettewe	Harasbedda
8.	,, T. Chas de Sylva	Naula
9.	,, M. B. Boange	Wahacotte
10.	,, R. S. Pelpola	Gampola
11.	,, Austin Abeysingha	Ukuwela
12.	,, D. D. Banda	Mawanella
13.	,, P. C. Rodrigo	Hettimulla
14.	,, K. A. J. Perera	Ruanwella
15.	,, H. S. Perera	Helamada

Southern Division (under Mr. G. Auchinleck.)

1.	Mr. M. J. A. Karunanayake	Matara
2.	,, B. G. Buultjens	Matara
3.	,, H. C. Peiris	Weligama
4.	,, Geo. Seneviratne	Galle
5.	,, W. F. Seneviratne	Bandaragama
6.	,, D. T. J. Weerasuriya	Panadura
7.	,, J. C. Abayawardena	Elpitiya

Northern Division (under Mr. N. Marshall.)

1.	Mr. K. C. Pillai	Jaffna
2.	,, V. Ramanathan	Mannar
3.	,, A. V. Chelvanayagam	Trincomalie

The remaining Instructors who have not yet been drafted for service under Divisional Agricultural Officers will continue as at present—under the direct supervision of the Director of Agriculture. They are : —

1.	Mr. L. A. D. Silva	Ratnapura
2.	,, P. B. Kapuwatte	Ratnapura
3.	,, Geo. Madugalle	Godakawela
4.	,, J. D. Nicholas	Balangoda
5.	,, J. A. Rambukpota	Badulla
6.	,, A. B. Attygalle	Veyangoda
7.	,, N. Thambiah	Batticaloa
8.	,, A. C. W. Jayawardena	Kurunegala
9.	,, P. A. Goonaratne	Dandegamuwa

Mr. N. WICKREMARATNE, who was the first Instructor to join the Society and who has been for some years Secretary to the Board of Control of Co-operative Credit Societies, was honoured with the rank of Muhandiram on King's Birthday—a mark of appreciation which the Society's staff gratefully prize.

PUBLICATIONS.

Consequent on the impending changes, the TROPICAL AGRICULTURIST will become the organ of the Department of Agriculture from October next. The Vernacular Magazines—the "Govikam Sangarawa" (Sinhalese) and "Kamat Tholil Velakkam" (Tamil) will also be continued.

The 1919-20 Edition of the Year Book has completely run out of stock. This little book proved very popular and enquiries for 1921 edition are often being received. Judging from enquiries from abroad, the book appears to be much appreciated. Owing to increased cost of printing and materials the publication of a new edition was put off, but the question of early printing a new edition deserves attention.

SEED DISTRIBUTION.

This question has constantly engaged the attention of the Society and every facility is afforded the large and small cultivators—with supplies of not only seeds but cuttings, tubers, yams, etc., throughout the year. Applications are being received from abroad too, and these receive very careful attention. With better facilities now provided—in the way of suitable accommodation and better equipment,—it is hoped this branch will develop into a very useful and important division in the Department of Agriculture.

The following is a statement of the seeds distributed since the beginning of the current year :—

Varieties.	*Quantities.*			
	Bushels.	*Pounds.*	*Packets.*	*Number.*
Paddy	243½	—	—	—
Maize (Indian Corn)	6½	23½	26	—
Maize (South African)	229¾	46	—	—
Dhall	—	20¼	27	—
Sorghum	—	38½	—	—
Kurakkan	40	—	—	—
Curry Stuffs	—	—	21	—
Yams	—	19½	—	300
Ginger	—	11½	—	—
Turmeric	—	10	—	—
Papaw Seeds	—	1½	12	—
Cuttings (Sweet Potato)	—	—	—	2250
,, Cassava	—	—	—	500
Vegetable Seeds	—	66½	9504	—
Plantain suckers	—	—	—	100
Pine-Apple Suckers	—	—	—	100
Grafted Plants	—	—	—	200
	519¾	237¼	9590	3450

INCREASED CULTIVATION OF FOOD CROPS.

The interest in this subject has not abated. Considerable attention continues to be paid to it by the Society and its officers. In addition to introduction of varieties of paddies, etc., an adequate supply of seeds of vegetables and other crops was made available to all throughout the year. In spite of there being two regular planting seasons, experience shows that variation in weather conditions is so diverse as to necessitate a regular supply throughout the year to meet applications from one district or another.

Selected seeds of the following varieties of *paddy* have been imported and given for varietal tests by MR. ILIFFE, the Economic Botanist, as these varieties are reported to have proved best in the localities named in their farm tests :—

Name of Paddy.	*Imported from*
Sadai Samba	... Bengal
Indrasail	... Bengal
Katakhara	... Bengal
Nagasein	... Burma
Ngachima	... Burma

Water-resisting paddy : *Tadaungbo* from Burma.—In view of persistent demands from districts in the Western and Southern provinces which are subject to periodical floods, efforts were repeatedly made since 1912 to introduce a variety that can resist floods effectively and so prevent large areas going out of cultivation. Enquiry revealed that "Tadaungbo" from Burma was suitable. Repeated trials, with fresh supplies obtained every year from Burma, were made—in various localities and under different conditions—but with no satisfactory or decisive results. It was pointed out to authorities in Burma recently that "we have here some areas which generally are

submerged in heavy rain when paddy plants are a few weeks old and keep the plants under water for 10 to 15 days—with the result that the plants rot and crops fail. It was to overcome this that your Tadungbo was imported and the failure hitherto is believed to have been more or less due to want of knowledge of its characteristics." The secret of failure was revealed in the following reply: "Tadaungbo paddy would not be of any use for the conditions you refer to. It is a variety that succeeds on land where there is a long duration of flood. It branches and grows with the rise of the water."

Two substitutes considered more suitable were obtained from Dacca through the courtesy of the Agricultural Adviser to the Government of India. These are (1) *Changa Aman* and (2) *Shachi*. Both are under trial and reports will be available in due course. They are described as follows:—

> "This class of rice is sown early in the season on lowlands subject to flooding and attains sufficient growth to withstand submersion."

An assorted supply of *Ceylon Hill-paddy* (Elwi) consisting of 127½ bushels was sent three months ago to the Government of Papua. The consignment was made up of 13 well known varieties.

Manurial Experiments.—The efforts at increase of food production were augmented by Government Paddy Manurial Experiments in the various provinces, under the direction of the Government Agricultural Chemist. 45 centres were selected, each centre having 4 plots under different treatment—viz. (1) Green Manure (1 ton) and Ephos Phosphate (1 cwt. per acre); (2) Fish Guano, Ephos Phosphate and Nitrolim—(224 lb. per acre); (3) Sterilised Animal meal and steamed bone meal—(168 lb. per acre); (4) Control. The average cost per acre was about Rs. 15. These trials were carried out owing to the urgent necessity of increasing food production—the chief object being to demonstrate the effect of artificial manures, green manuring and better cultivation of the soil on the growth and yield of paddy. A detailed report of the results has been submitted to Government.

Curry-Stuffs.—Trials were made with curry-stuffs during last 4 or 5 years with the view of ascertaining the possibility of growing particular varieties in the various districts on a commercial scale. Mustard is found growing in many districts, while Anise and Fenugreek are noticed in Uda Dumbara and other centres. But the cultivation of any of the varieties on any *chena* scale is not noticed anywhere. The varieties tried were:—Anise, Cummin, Coriander, Fenugreek and Mustard. Seeds obtained from various sources were found not quite satisfactory and this year special efforts were successfully made to get seeds from the farms instead of relying on seeds available in the markets. Trials were made at Harasbedda, Kurunegala, Balangoda, Godakawela, Weligama, Bandaragama, Kegalle, Matale, Jaffna, Teldeniya, Batticaloa, Matara, Anuradhapura, Badulla, Peradeniya, Welimada and Puttalam. Except Coriander, reported to have done well at Dambawinne, the reports received from all centres are not very encouraging. Arrangements are being made to cultivate coriander at Dambawinne on a larger scale.

DISTRICT REPORTS

According to reports received from the Agricultural Instructors, various improvements are in progress:—

At Galle—"There is not only an increase in the cultivation of vegetables, but also better system in the preparation of beds, drainage and the increased use of cattle manure. In paddy cultivation, bone and green manure are being used on a larger scale than before. Water-resisting paddy so far promises to be successful. Seedlings are more healthy than the local varieties. Visits of inspection of vegetable plots for selection of prizes have stimulated the energies of many others, who will doubtless be competitors in the near future."

At Batticaloa—"Arrangements are being made to conduct further paddy manuring experiments during the coming Munmari season. Much time is devoted to paddy cultivation as the methods in vogue are too primitive with too poor results, though paddy is extensively cultivated. Cultivators now realise the advantages of green manuring. The acreage put under cultivation is on the increase. Improvement of cattle in the district is imperative. The importance of seed selection is now realised. Vegetable gardens are on the increase. Sugar-cane, cotton, dhall and castor plant can be encouraged. If the many minor tanks now abandoned are restored, many additional acres can be brought under cultivation."

At Matara—"Great advance in the improvement of paddy cultivation is noticeable. Manuring is readily adopted and transplanting—first started four years ago—has taken a permanent hold. During last Maha season, there were 88 plots transplanted in the pattu, with very encouraging results. There is a good number this season too; but Maha has been found to be the more suitable. A competition in transplanting with three prizes of Rs. 75, 50, 25 for the best 3 plots has been started for this Yala. Trials were conducted in manuring and transplanting in six schools and these are being continued this season with green manures instead of artificial. Well attended lectures were given at several centres on the advantages of green manuring, transplanting, seed selections, prevention of plant pests, etc. Issue of chena permits has been restricted, which I think is a good step, against the tendency on the part of the villagers to relax efforts in increasing output of paddy since the fall of price of imported rice.

Arrangements are made to hold 3 Shows—at Tihagoda, Dondra and Hakmana during July and August."

At Weligama—"Greater interest is evinced, both by proprietors and cultivators, in manuring paddy—as a result of demonstrations and meetings—the unmanured fields being less than 10% of the whole cultivated area. The efficacy of manuring is admitted by owners of this percentage and their adoption is only a matter of time."

"The general adoption of transplanting too is a matter of time, now that most of the cultivators are convinced by results of demonstrations of its economy and advantages. It is encouraging to watch the application of green leaves, especially *Keppiliya*, by almost all the cultivators. Vegetable cultivation has attracted the interest of the proprietors for family consumption. There is greater demand for seeds which is mostly met from the Experimental Garden. With the help of the Mudaliyar of Morawak Korale, meetings were held and interest has been roused in improved methods of cultivation and Co-operative Credit Societies as a means of improving village agriculture and the Social status of the peasant."

At Bandaragama—"Seed selection was carried out at various centres and ploughing demonstrations at 5. Two new Co-operative Credit Societies are arranged for Beruwala and Wallawita. Transplanting in paddy is carried on.

"Sunday Markets are under consideration for Elpitiya, Urugaha and Bentota. A scheme for awarding prizes for improved cultivation in Cinnamon and Rubber by small holders, so as to introduce better methods among them is under consideration."

"Special attention is devoted to paddy cultivation in *Kandyan* districts by awards of competitive prizes, demonstrations in manuring, and advocating more general use of green manure, thinner and more systematic transplanting, seed selection, etc. Agricultural meetings held by Instructors are well attended and more interest is taken in the discussions by the cultivators."

"Rotation of Chena crops, improvement of paddy cultivation, transplanting and manuring are more freely adopted in *Matale* district; tobacco is largely grown in some divisions. A show is proposed to be held. In lands opened up with tobacco, vegetables are grown as a catch crop."

In *Nuwara Eliya* district—"An Experimental Garden has been opened at Dipegoda in Maswela village. Cultivators are encouraged to take up vegetable cultivation by free gifts of seed which have satisfactorily germinated and promises good crops. Agricultural statistics are being gathered and the grant of Crown land to poor villagers owning no property to settle down is being recommended where desirable."

In *Wahacotte* division—"Most of the cultivators are adopting improved methods after witnessing the success achieved in the demonstrations in green manure, farm-yard manure, weeding and transplanting. In divisions where the crop was never grown before, Cassava now covers more than 15 acres this season as a result of advice urged on the villagers. Cattle-sheds are coming into existence and tethering is resorted to with the object of preserving the manure which is now generally being adopted. Hill paddy is being introduced to divisions where it is unknown."

At *Ratnapura*—"Transplanting in paddy cultivation is being largely adopted, in addition to other methods of improvement, increase in food production and Co-operative work. MR. CYRIL ELLAWELA, Proctor, realised a crop 162 fold from a field 1/3 acre transplanted with seedlings raised from 4 measures of paddy—the crop realised being 20¼ bushels. A cultivator at Batugedera from similar method obtained 170 fold from 1/14 acre transplanted with seedlings from ¾ measure, realising 4 bushels. Twelve similar experiments are in progress for yala. Cultivators are now convinced of the advantages of transplanting which is bound to be popular very soon in the locality and surrounding villages. Two village tanks are being repaired by the Irrigation authorities on the suggestion of the Instructor; a channel is also receiving attention."

At *Kurunegala*—"In the absence of an Experimental Garden, schoo gardens have been utilised as the medium of demonstration. The award of Rs. 100·00 by COL. WRIGHT should stimulate the Teachers to take more lively interest in the improvement of methods. The prizes which a few gentlemen have been induced to offer for Home Gardens of Students attending schools in the district have also given a stimulus in that direction. Dhall cultivation is steadily increasing; coconut estates are taking to it as a green manure in addition to its food value, and also as a weed-killer. The dry barren lands of Wanni Hatpattu should find this a valuable crop. Improvement in transplanting paddy is expected as a result of a special prize of Rs. 50 in cash promised for best plot by school boys. A Co-operative Credit Society has been organized at Narammala and 2 Shows are projected for Dambadeni and Weuda Wili Hatpattus.

"Much improvement in paddy cultivation is expected at *Godakawela*. The number of village gardens are increasing. Irrigation channels and tanks are receiving attention and the villager is impressed of the value of uniformity in cultivation. Financial difficulties of *goiyas* should be much relieved by the Co-operative Credit Societies established at Godakawela and Kahawatta. Advances for manure and financial aid to the extent of Rs. 1,800 were given and the Godakawela Society has approached Government for a loan of Rs. 1,000 to extend its operations."

At Balangoda—"Demonstration plots in transplanting, green manuring, clean weeding, etc. are being conducted in 25 places. Bee-keeping has been introduced into several schools; a Co-operative Credit Society has been established for Balangoda at the garden; various other experiments are being conducted."

"The experiments with artificial manure for paddy at *Trincomalie* have proved encouraging. On the outbreak of paddy-fly during *Munmari* at Vipanakulam a successful demonstration was made of the fly-net, which has been readily adopted by the cultivators in destroying flies. At Thadakai a series of important experiments are being conducted under tank irrigation—with coffee, Kew pine and "Mauritius" varieties of pine, plantains, castor, pepper, cassava, sweet potato and fodder grasses. Castor and pepper failed owing to local conditions; but the other crops are growing very satisfactorily."

At Ukuwela—"Attention was devoted to increase of food crops in general, and improvement of paddy cultivation in particular—manuring, transplanting, ploughing, seed selection, and clean weeding being urged."

PERMANENT HEDGES FOR CHENAS.

The difficulty experienced in many districts in growing chena rotation crops on a permanent basis is the damage caused by cattle and wild beasts. With a view to testing their adaptability to particular areas, the Society is having varieties of seeds tried in various districts. They include Daluk (*Euphorbia antiquorum*), Sapan; Perunkila (*Carissa spinarum*), (Chirukkila Tamil); vidattal: *Dichrostachys cineresa*.

REPORTS.

Castor-Cake as Manure.—The following report was received from the Government Agricultural Chemist on a sample of the surplus Castor Cake from the Railway submitted for investigation as to its manurial value:—

"Moisture	7·50%
Ash	4·30%
Sand	1·20%
Organic Matter	87·00%
	100·00
Nitrogen	4·42%
Oil	16·30%
Phosphoric Acid	1·22%
Potash	1·10%

"This sample is quite suitable for manurial purposes but is not considered superior to what is on the market.

"Another sample sent by the Ceylon Government Railway contained:

Oil	21·00%
Nitrogen	4·17%"

Methods of Extracting Papaine.—With regard to the question as to the possibility of extracting papaine by chemical means from either dried or green fruit, or the dried ripe fruit, suggested by the Hon'ble the Director of Agriculture owing to the present unsatisfactory methods of securing supplies, the Government Agricultural Chemist has arranged for experiments on new lines. He reports :—

> "It might be possible to express the juice from ripe and unripe fruits and after filtering to precipitate the papaine with Sulphate of Ammonia and purify by re-solution and precipitation, finally with alcohol. Some years ago we prepared a pure papaine from crude papaine in this way. The fruits might also be sliced and sun-dried, and then disintegrated and extracted with water or glycerol and purified as above. As it is believed that the leaves and stems contain papaine, an experiment might be tried disintegrating the whole plant and extracting with water and purifying. Chemical tests as to the digestive power of such extracts could be devised, or samples sent to the Imperial Institute for valuation."

I cannot conclude this report without offering the Society's congratulations to the HON'BLE MR. STOCKDALE, the Director of Agriculture, who has been elevated to a seat in the Legislative Council and who as Organising Vice-President of the Society, has endeavoured to improve the agriculture of the villager.

Peradeniya, 6th July, 1921.

M. KELWAY BAMBER,
Secretary.

REPORT OF THE SPECIAL SUB-COMMITTEE OF THE CEYLON AGRICULTURAL SOCIETY.

Your Committee was appointed at a meeting of the Society held on 2nd February, 1921, and consisted of the Director of Agriculture (Chairman), Sir Ponnambalam Arunachalam, Hon. Dr H. M. Fernando, Dr. C. A. Hewavitarne, Lt.-Col. T. G. Jayawardene, Hon. Mr. James Peiries, Messrs. C. Drieberg, A. W. Beven and M. Kelway Bamber (Secretary).

MR. G. B. DE GLANVILLE was subsequently added.

The Committee held 3 meetings, viz.—on 7th March, 7th April and 4th May, 1921, and have arrived at the following conclusions which are now submitted for adoption :—

(1) That the Society should be entitled The "Agri-Horticultural Society of Ceylon."

(2) That the TROPICAL AGRICULTURIST should be issued free to all members of the "Agri-Horticultural Society" resident in Ceylon and the members pay an annual subscription of Rs. 10 to the Society.

(3) That the non-resident subscribers should subscribe direct to the TROPICAL AGRICULTURIST at Rs. 15 per annum as at present, and should not be enrolled as members of the "Agri-Horticultural Society."

(4) That membership of the "Agri-Horticultural Society" be confined to Ceylon residents.

(5) That the Agricultural Instructors be taken over by the Department of Agriculture.

(6) That the present organization for Seed Distribution be continued by the Department.

(7) That meetings and conferences be held at Colombo.

(8) That balance of funds at the end of current financial year revert to the Society and that Government be approached for an initial grant of Rs. 10,000 and for annual grants-in-aid, revised from year to year subsequently.

(9) Provisional Estimates were decided upon as follows :—

Building—to cost	...	...	Rs. 5000·00
Secretary—per annum	...	...	,, 3000·00
2 Clerks 1 @ Rs. 600 per annum 1 @ ,, 720 per annum	...	...	,, 1320·00
Peon and Messenger	...	...	,, 240·00
Foreman and Seedsman	...	...	,, 360·00
Head Gardener	...	...	,, 360·00
5 Coolies at Rs. 20 per month		...	,, 1200·00
Lease of land or Office accommodation			,, 1200·00
Postage, etc.	...	...	,, 600·00
Stationery	...	...	,, 500·00
Contingencies	...	...	,, 2200·00
Seeds and Plants	...	...	,, 4000·00
			Rs. 19,980·00

or approximately a sum of Rs. 20,000·00 to be made up as follows :—

Subscriptions	...	...	Rs. 6000·00
Revenue from sale of plants	...	...	,, 4000·00
Govt. Grant	...	...	,, 10000·00

(10) That the rules adopted at the meeting of the Agricultural Society on October 29th, 1919, be slightly amended for adoption as follows :—

1. The Society shall be called the "Ceylon Agri-Horticultural Society," and its object shall be the advancement of Agriculture and Horticulture in the Island.
2. The Office-bearers of the Society shall be the President, Two Vice-Presidents, and a Secretary & Treasurer elected at the Annual General Meeting. The Secretary & Treasurer may be paid such remuneration as may from time to time be fixed.
3. The business of the Society shall be conducted by a Committee consisting of the Office-bearers and twenty-five members elected at the annual general meeting. Such Committee shall have the power to incur expenditure in carrying out the objects of the Society. Five members shall form a quorum.
4. The Committee shall meet at least six times a year.
5. A General Meeting of the Society shall be held at least once in six months.
6. Notices of motions and questions shall reach the Secretary and Treasurer at least a week before a meeting of the Society.

7. Candidates for membership shall be proposed and seconded by members of the Society *pro forma* and such proposals shall be considered and dealt with by the Committee, whose decision shall be final. Residents in Ceylon only are eligible for membership.
8. Members shall pay an annual subscription of Rs. 10. The Society's year shall be the calendar year, subscriptions being payable in advance for that period.
9. Payment of subscription will entitle members to receive the publications of the Society and the TROPICAL AGRICULTURIST.
10. Local affiliated Societies may be formed with a membership of not less than twelve.
11. The funds of the Society shall be lodged in a bank in the name of the "Ceylon Agri-Horticultural Society." The Secretary and Treasurer will be responsible for the accounts and all cheques will be signed by him and one of the Vice-Presidents.
12. A statement of income and expenditure shall be tabled at each general meeting of the Society.
13. The Accounts shall be audited annually and published.

The question of housing the new Society in Colombo received serious consideration and after discussing 9 likely sites, the Chairman placed the views of the Committee before the Hon'ble the Govt. Agent, W. P., who indicated 4 sites as being likely to be available, viz.,

a. Area near Model Farm on Ridgeway Golf Links.

b. Area behind Jail Road and opposite Campbell Park.

c. Area behind Havelock Town near Greenlands Road—part of this liable to be flooded.

d. Area near the Cemetery and to the South of same.

These have been visited by the Chairman and the Hon'ble Dr. H. M. Fernando. They recommend that site *d* above be selected.

(Signed) F. A. STOCKDALE.
" P. ARUNACHALAM.
" H. M. FERNANDO.
" C. A. HEWAVITARNE.
" T. G. JAYAWARDENE.
" JAMES PEIRIES.
" C. DRIEBERG.
" A. W. BEVEN.
" M. KELWAY BAMBER.

[*Minutes of Proceedings are appended.*]

Peradeniya, 6th July, 1921.

SELECT SUB-COMMITTEE.

A

Minutes of Proceedings of a Meeting of the Select Sub-Committee of the Ceylon Agricultural Society, held at 11·30 a.m. in the Legislative Council on Monday, the 7th March, 1921.

Present:—The Director of Agriculture (Chairman), Lt.-Col. T G. Jayawardena, Messrs. James Peiries, C. Drieberg, A. W. Beven and M. Kelway Bamber (Secretary).

MR. DRIEBERG submitted the following :—

MEMORANDUM ON THE

RECONSTITUTION OF THE CEYLON AGRICULTURAL SOCIETY. :—

The C. A. S., as intended by its founder, was the fore-runner of the Government Department of Agriculture, and prepared the way for it. It took to itself executive functions under the official aegis and, in time, got together a large staff of officers for carrying on work which properly falls within the administration of a Department.

From its original home in Colombo it was moved to Peradeniya in order to be in touch with the department then in course of formation; and eventually joined forces with it.

Now that the Department has grown—though still undeveloped on its agricultural side proper—it is to be presumed that it will take up the executive functions of the Society, which as such has, sometimes since, lost its individuality, and become practically merged into the Department. The entire office and office staff and body of instructors will, it is expected, also go over.

The question then arises whether there is any necessity for the Agricultural Society to be reconstituted, in order to carry on duties as an unofficial organisation.

I am of opinion that there is, and I would suggest that it should be reorganised on the lines of the Agri-Horticultural Society of India, with certain modifications to suit local conditions.

The need for such a Society, working under Government auspices, but quite distinct from the Department of Agriculture, is, I think, keenly felt.

Prior to the founding of the C. A. S., there existed an Agri-Horticultural Society in Colombo which for many years carried on a useful work, and was a very popular institution. Subsequently it became over-shadowed by the C. A. S., and, as I am informed by its last Secretary, it is now practically wound up.

With the increased interest, apparent everywhere, in what may be termed amateur agriculture and horticulture, it seems very desirable that some association should be formed to encourage and foster all branches of work that fall under these two heads :—viz., the growing of suitable grains, tubers, vegetables, fruits, fodders, etc. as garden rather than as estate crops, and with these the cultivation of ornamental flowering and foliage plants, also, with a view to supplying the wants of the growers themselves as well as for purposes of sale.

One cannot but notice the change of outlook—as a result no doubt of conditions arising from the war—that has come to the various communities of this Island. There appears to be a general desire among people to practise economy, and supplement their incomes by growing edible crops and ornamental plants in their own gardens.

It would be most unwise to allow this desire, which has generated a spirit of industry and enterprise, to die out, as it surely will, unless a living interest is maintained in such work through an organisation which will be in a position to assist the workers in every possible way. It is needless to particularise here, in what ways such an association can assist; but as past Secretary both of the Colombo Agri-Horticultural Society and of the C. A. S., I am convinced there is ample scope for a reconstituted Society whose functions should be both Agricultural and Horticultural.

The work of such a Society need not, and should not, clash with, or overlap that of, the Department which is in the main concerned with estate products, and farming and planting operations on a more or less extensive scale; and also to a great extent with research work connected therewith. The officers of the Department have onerous and multifarious duties to perform in their offices, laboratories and in the field, and it would be unreasonable to expect them to find the time to attend to the demands, more or less personal, of the class of people to whom the new Society will cater.

The Headquarters of the Society should be, if possible, in Colombo, and its office should occupy a site which will provide sufficient room for a garden, as in Calcutta and Madras.

The revised rules adopted at a special general meeting of the C. A. S., on October 29th, 1919, might with a few alterations be adopted ; and, if found necessary, added to.

Rule 9 provided that members of the Society will be entitled to the publications and the T. A.; but if, as has been suggested, the T. A. is to be taken over by the Department, then some arrangement should be arrived at whereby the Society will be given a sufficient number of copies free of charge for its members.

If necessary, the Society might also issue to its members a supplement, to go out with the T. A., dealing with its own work, in the form of articles, correspondence, etc., etc.

It is to be hoped, however, that the T. A. will be more efficiently managed when taken over by the Department, for of late the Magazine, except occasionally, has not been up to the standard of the first Agricultural publication in the Eastern Tropics which it purports to be.

Like the Agri.-Horticultural Societies of India and Madras, the Ceylon Society should stock seeds and maintain a nursery garden for the benefit of its members. It should also encourage the study of plant life by means of popular lectures and leaflets, and push the cultivation of useful crops among small land-owners and tenants, many of whom are found in urban and suburban areas.

To the Agricultural Department the Society must look for such advice as the former would be in a position to give, whenever applied to, on technical matters, which only its scientific officers are qualified to deal with.

The property of the C. A. S., in money and kind will, it is presumed, come to the proposed Agri-Horticultural Society of Ceylon, as its legitimate successor ; while Government must be looked to for a generous grant, and such other assistance as it may be disposed to give.

Those present expressed the general approval of the suggestions therein contained.

The following decisions were adopted :—

(1) That the Society should be entitled The Agri.-Horticultural Society of Ceylon.

(2) That the TROPICAL AGRICULTURIST should be issued free to all members of the Agri-Horticultural Society resident in Ceylon and that members pay an annual subscription of Rs. 10·00 to the Society.

(3) That the non-resident subscribers should subscribe direct to the TROPICAL AGRICULTURIST at Rs. 15·00 per annum as at present and should not be enrolled as members of the Agri-Horticultural Society.

(4) That membership of the Agri-Horticultural Society be confined to Ceylon residents.

(5) That the Agricultural Instructors be taken over by the Department of Agriculture.

(6) That the present organization for Seed Distribution be continued by the Department.

(7) That meetings and conferences be held at Colombo.

(8) That balance funds at the end of current financial year revert to the Society and that Government be approached for an initial grant of Rs. 10,000·00 and for annual grants-in-aid revised from year to year subsequently.

(9) That estimates be prepared by a Sub-Committee consisting of DR. H. M. FERNANDO, LT.-COL. T. G. JAYAWARDENA, and MR. C. DRIEBERG.

(10) That enquiries be made in Colombo as to land being available for office and for a nursery garden in Colombo.

(11) That the rules adopted at the meeting of the Agricultural Society on October 29th, 1919, be slightly amended for adoption as follows :—

1. The Society shall be called the Ceylon Agri-Horticultural Society and its object shall be the advancement of Agriculture and Horticulture in the Island.

2. The Office-bearers of the Society shall be the President, Two Vice Presidents, and a Secretary & Treasurer elected at the Annual General Meeting. The Secretary & Treasurer may be paid such remuneration as may from time to time be fixed.

3. The business of the Society shall be conducted by a Committee consisting of the office-bearers and twenty-five members elected at the annual general meeting. Such Committee shall have power to incur expenditure in carrying out the objects of the Society. Five members shall form a quorum.

4. The Committee shall meet at least six times a year.

5. A General Meeting of the Society shall be held at least once in six months.

6. Notices of motions and questions shall reach the Secretary & Treasurer at least a week before a meeting of the Society.

7. Candidates for membership shall be proposed and seconded by members of the Society *pro forma* and such proposals shall be considered and dealt with by the Committee, whose decision shall be final. Residents in Ceylon only are eligible for membership.

8. Members shall pay an annual subscription of Rs. 10·00. The Society's year shall be the calendar year, subscriptions being payable in advance for that period.

9. Payment of subscription will entitle members to receive the publications of the Society and the TROPICAL AGRICULTURIST.

10. Local affiliated Societies may be formed with a membership of not less than twelve.

11. The funds of the Society shall be lodged in a Bank in the name of the Ceylon Agri-Horticultural Society. The Secretary & Treasurer will be responsible for the accounts and all cheques will be signed by him and one of the Vice Presidents.

12. A statement of income and expenditure shall be tabled at each general meeting of the Society.

13. The accounts shall be audited annually and published.

It was decided to hold the next Meeting of the Committee at the Legislative Council Chamber at 11-30 a. m. on Friday the 1st April. 1921.

B

Minutes of proceedings of a Meeting of the Select Sub-Committee of the Ceylon Agricultural Society, held in the Legislative Council Chamber at 2 p.m. on Thursday, the 7th April, 1921.

Present:—The Director of Agriculture (in the Chair), Sir P. Arunachalam, Hon. Dr. Fernando, Mr. A. W. Beven, Mr. C. Drieberg and Mr. M. Kelway Bamber (Secretary).

Minutes of the previous meeting held on 7th March were taken as read and confirmed.

Discussed sites as likely to prove suitable for the location of the office and garden—viz. at Victoria Park, Mattakkuly and Angulana. It was decided that 2 acres if obtainable at Victoria Park would be most suitable Failing this Mutwal was decided on as an alternative.

Provisional Estimates after discussion were decided upon as follows:—

Buildings—to cost	Rs. 5,000·00
Secretary - per annum	,, 3,000·00
2 Clerks:	
1 @ Rs. 600·00 per annum ...	,, 1,320·00
1 ,, ,, 720·00 ,, ,, ...	
Peon & Messenger	,, 240·00
Foreman & Seedsman	,, 360·00
Head Gardener	,, 360·00
5 Coolies @ Rs. 20·00 per month ...	,, 1,200·00
Lease of land or Office accommodation	,, 1,200·00
Postage, etc.	,, 600·00
Stationery	,, 500·00
Contingencies	,, 2,200·00
Seeds and Plants	,, 4,000·00
	Rs. 19,980·00

Or approximately a sum of Rs. 20,000·00 to be made up as follows:—

Subscriptions	Rs. 6,000·00
Revenue from sale of plants ...	,, 4,000·00
Govt. Grant	,, 10,000·00

It was decided to enquire from the Hon. the Govt. Agent, W. P., and the Mayor of Colombo, *re* possible available lands and invite them to join the Committee.

It was also decided to enquire from the Hon. the Govt. Agent, W. P., whether the site at present occupied by the Infectious Diseases Hospital at Buller's Road would be available.

The suggestion that the HON. MR. J. G. FRASER be asked to become a Vice-President of the proposed Agri-Horticultural Society was agreed to.

With a vote of thanks to the Chair the meeting terminated—the CHAIRMAN, DR. FERNANDO AND MR. DRIEBERG being delegated to inspect and report on the sites discussed.

The next Meeting was fixed for May 4th at 2 p. m.

C

Minutes of proceedings of a meeting of the Select Sub-Committee of the Ceylon Agricultural Society, held in the Legislative Council Chamber at 2 p.m. on Wednesday, the 4th May, 1921.

Present :—The Director of Agriculture (in the Chair), Sir P. Arunachalam, Mr. G. B. de Glanville, Dr. C. A. Hewavitarne, Mr. C. Drieberg and M. Kelway Bamber (Secretary).

Minutes of the previous meeting held on 7th April, 1921, were read and duly confirmed.

Read letter from the Hon'ble the Govt. Agent, W. P., regarding sites for office accommodation and garden for the proposed Agri-Horticultural Society.

DR. HEWAVITARNE suggested a 2-acre block of land just beyond the Police Sports Club up Tannery Road.

Other likely sites discussed were :—

(1) A 2-acre block of land near the Police Sports Club at the end of Tannery Road.

(2) Area near the Model Farm on the Ridgeway Golf Links.

(3) Triangular plot of land at corner of Cambridge Place and Race Course Avenue, adjoining Rowallan and Wentworth Bungalows.

(4) Portion of lake near Braybrooke Lodge now being filled up.

(5) Plot of land behind the Jail Road and opposite Campbell Park.

(6) Corner plot of land near Lunatic Asylum on Buller's Road.

(7) Corner plot of land near Prince's Club, and end of Straight Race Course.

(8) Crown land just behind Havelock Town, near Greenland's Road.

(9) Land at Corner of Gregory's Road and Buller's Road.

It was decided that the CHAIRMAN should interview the Govt. Agent, W. P., in regard to the above specified sites.

MR. DE GLANVILLE pointed out that any of the areas mentioned above may come under the proposed scheme for taxation on Capital Value—say 1 % per annum.

It was decided to communicate to the committee the results of the interview with the Govt. Agent, and then draft out the report of the Sub-Committee for submission to the Society at its next meeting.

D

To the Members of the Special Sub-Committee of the Ceylon Agricultural Society.

The following proposed sites for the headquarters of the "Agri-Horticultural Society" were discussed in detail on May 5th with the Govt. Agent, W. P.

Site No. 1. A 2-acre block of land near the Police Sports Club at end of Tannery Road.
This block is reserved and will not be available.

,, ,, 2. Area near the Model Farm on the Ridgeway Golf Links.
This site is possible and is considered by MR. FRASER as being fairly favourable.

,, ,, 3 Triangular plot of land at corner of Cambridge Place and Race Course Avenue, adjoining Rowallan and Wentworth Bungalows.
This site is reserved for building blocks and could be utilised only for a short period. It is not recommended.

,, ,, 4. Portion of lake near Braybrooke Lodge now being filled up.
This site is reserved for building blocks and could be utilized only for a short period. It is not recommended.

,, ,, 5. Plot of land behind the Jail Road and opposite Campbell Park.
Some of this land has been leased to Ananda College and to the Y. M. C. A. for purposes of recreation. The Western portion of about 2 acres is still available and might be suitable. The frontage of the remaining portion is somewhat narrow, but is considered to be wide enough for the purpose of the Society.

,, ,, 6. Corner plot of land near Lunatic Asylum on Buller's Road.
This plot is reserved for a definite building purpose and would not be available,

,, ,, 7. Corner plot of land near Prince's Club, at end of straight Race Course.
This area will not be available.

,, ,, 8. Crown land just behind Havelock Town, near Greenlands Road.
This is a block of 3 acres and a portion of it is liable to be flooded.

,, ,, 9. Land at Corner of Gregory's Road and Buller's Road. This will not be available.

2. MR. FRASER drew my attention to a portion of land available near the Cemetery opposite Kitulwatte Road which he considers would be suitable.

3. It therefore seems that the various possible sites are as follows :—

a Area near Model Farm on Ridgeway Golf Links.

b Area behind Jail Road and opposite Campbell Park.

c Area behind Havelock Town, near Greenlands Road—part of this liable to be flooded.

d Area near the Cemetery and to the south of same.

4. I would be glad if members would indicate which they consider the most suitable, so that the draft report of the Sub-Committee may be prepared for final consideration.

Signed F. A. STOCKDALE,
Chairman.

12th May, 1921.

COCONUT CULTIVATION IN 1881 AND IN 1921.

A. W. BEVEN.

I was asked by our Secretary to read a paper on any subject I liked, at this meeting. As there was no new subject on which I could write, I intended originally to decline the compliment paid me by such a request. On second thoughts I was inclined to think that it would have been churlish to do so, and that members, whose memories and experience of coconut planting did not go back as far as mine did, will be interested to know what coconut cultivation was like forty years ago.

When I commenced coconut planting in 1881, the cultivation on estates was primitive, and was a little more advanced than what was practised by our neighbours in the villages. Weeding was done once or twice a year. A man was considered an advanced Agriculturist who weeded oftener.

The application of "artificial" manure was an unknown quantity. Cattle were tied to coconut trees, and their droppings were turned into the soil. To conserve all the droppings, especially in seasons of rain, the soil round the trees, to the width of about a fathom (6 ft.) was scooped out. With the advent of "artificial" manures and their extended use, those who have experience of "natural" and "artificial" manuring, will, I feel sure, give the palm to the results of "natural" manuring. The experience of local Agriculturists is the same as that of Agriculturists in Europe—that as far as results go, "dung" cannot be beaten. The droppings from the coconut trees were also burnt periodically and the ashes remained *in situ*, and those who were not too lazy to do so, collected the ashes and spread them round the coconut trees.

Ploughing was unknown and tilling was confined to a circle round the trees.

The preceding sums up coconut cultivation in the Eighties. Early in the Twentieth century, I was given the charge of a large coconut estate in the Chilaw District—the oldest or one of the oldest there. Its former owner owned coconut oil-mills in Colombo and the legend was, that most of the outturn in poonac of those mills was applied to the trees on this estate. The soil of the estate is a poor sand and the trees were more or less "played out." The padda-boats that took to Colombo the produce of the estate in copra and fibre, brought back loads of cattle manure, collected in the "galas" or the halting places of carts in Colombo. As this manure was not collected under shelter, the monsoon rains washed out all the soluble constituents it contained. It yet had a value, as decayed vegetable matter, to form humus, in a hungry sandy soil almost devoid of humus. The measure of the fertility of a soil is the amount of humus it contains, as the humus gets exhausted, the fertility of a soil is lowered. Besides cattle manure, the trees used to be supplied with a certain amount of castor-cake. I was asked not to apply any other "artificial" manure, as the results of the application of castor-cake alone were tested and were assured. The estate was weeded about once a quarter and the droppings from the trees were heaped up in different places and burnt at night-fall, to attract and destroy all winged enemies of the coconut palm.

Systematic ploughing was practised only in my time. Half the estate was ploughed and then manured in alternate years. The manure I applied was a mixture of phosphoric acid, nitrogen and potash prescribed by me and gave very encouraging results. The crops which previously never exceeded one and a half million nuts per annum, reached two millions, and in one year were nearly two and a half millions. Harrowing was not practised in those days because it and its benefits were unknown. I can say with some measure of pride, that I was the apostle of dry-farming in Ceylon. I had read

a good deal of literature on dry-farming, and its benefits made so great an impression on me that I was very anxious that it should be generally adopted in coconut cultivation.

I read a paper on Dry-Farming at a meeting of the Agricultural Society. It received the support and benediction of the then Director of Agriculture and his Department. The practice caught on and many estates practised it. It was specially useful on the North and South of the Deduru Oya, in the Chilaw district.

A well-known gentleman, who owned estates North and South of the Deduru Oya, adopted it only after it had received the support of the Department of Agriculture. Till then, my personal suggestion received as scant support as the biblical voice in the wilderness. This gentleman was so full of its benefits, that he wrote a gushing letter to the papers that he was now in a position to snap his fingers at the annual droughts which played havoc with his crops and trees also. The use of the harrow followed that of the plough, so that hard soils could be thoroughly pulverised to form a soil mulch on the surface and to prevent the evaporation of the moisture in the sub-soil.

Every good agricultural operation has its drawback, and it is possible to overdo the thorough cultivation of the soil. As has been said before, the measure of the fertility of any soil is the humus it contains. Cropping reduces the reserves of humus in a soil, unless vegetable matter is added to it. Now, a sandy soil is almost devoid of humus, and if a coconut estate on a sandy soil be harrowed constantly, the growth of grass and weeds is checked, and no humus-forming matter is turned into the soil, and the soil becomes gradually, but surely, impoverished. I have in my mind's eye an estate with a sandy soil, that gave larger crops when ploughed in alternate years, than it does now, with monthly or bi-monthly harrowing and consequent clean weeding. On heavy, clayey and alluvial soils, the growth of weeds and herbage is rank, and constant harrowing not only renders the soil porous and friable, but turns the rank growth of vegetable matter into rich humus, which has both chemical and mechanical beneficial effects on the soil.

Liming the soil is another operation, which has only been practised in recent years. In European Agriculture, which is the cultivation of annuals and not of perennials, it was the practice to apply large quantities of lime at long intervals. The soil was decomposed and large quantities of insoluble elements of fertility were set free and consumed by the crops. The soil got temporarily exhausted and crop was reduced. This is the origin of the saying that "Lime enriches the father but impoverishes the son." Wiser methods prevail now. Experience has proved that small doses of lime, applied frequently, yield better results than large doses at distant intervals. People unacquainted with lime and its beneficial action, sometimes complained that an application of lime threw back their coconut trees.

Not long ago, I happened to visit a group of estates belonging to a prominent Sinhalese gentleman. When I suggested to the man in charge the application of lime to fields where the soil was hard and clayey, he offered to show me a field of coconut where the trees developed a peculiar disease after lime had been applied to it. Before seeing that field, I suggested frequent stirring of that soil. I discovered subsequently that the trees were affected by a severe attack of grey blight, and I pointed out another field similarly affected, that had not been limed. Recently, on the Railway Platform at Kandy, the most prominent Sinhalese official in Ceylon, told me that unsatisfactory results followed the application of lime to a coconut estate of his. I could give no explanation without seeing the estate.

When discussing lime it will be useful to suggest how it should be applied. I always tilled or ploughed the land first and then broadcasted the lime at the rate of about ½ a ton to the acre as a maximum amount. The lime will not only disintegrate the soil, but will also help to decay the vegetable matter, turned into the soil and form humus.

On estates that are not well cultivated, can be seen large accumulations of husks. Very few people realise what a valuable asset these husks are. According to MR. BAMBER, the ashes of husks contain 46% of salt, 30·7% of potash, 4·14% of lime and 1·92% phosphoric acid. Many intelligent planters sell their husks for the sake of the few rupees they bring in. This policy is short-sighted and suicidal. Planters do not know how to dispose of their husks. The husks should not be allowed to accumulate, but should be buried in trenches, and as each set of trenches is filled up, fresh ones should be cut to replace them, and be treated similarly. Some people prefer to burn their husks to burying them, as husks take so long a time to decay. What is gained by the quick application of the constituents of the husks to the soil in the form of ashes, is more than lost by the dissipation of the valuable gases in burning, and the humus that results from the decay of husks.

What I have detailed above represents a few of the modern methods of coconut cultivation, not practised in 1881 and afterwards.

A CLEAN WEEDING *Vs.* CATTLE FOR MANURING COCONUT ESTATES.

This question was raised by me personally some time ago and again recently by a very prominent Sinhalese estate-owner. The belief in the value of cattle dung as a fertiliser is shared in by me, specially as it is applied on coconut estates direct by cattle to the trees. Those who pin their faith in the droppings of cattle grazed only on their estates, do so blindly and unreasoningly. Nothing is added to the fertility of the estate, unless the cattle are fed with food procured from outside. Grazing cattle on an estate means, in plain language, removing the crop of grass from over the whole estate and applying it to a few trees, after the cattle have abstracted sufficient for their sustenance and growth.

It will therefore be seen that manuring an estate with droppings of cattle, grazed only on that estate, adds no elements of fertility to the soil of that estate. It is simply robbing Peter (the whole estate) and paying Paul (the few trees manured with the droppings). If the herbage growing on an estate be turned into the soil, exactly where it grew, the whole surface of the soil is manured. The decay of the herbage improves the soil mechanically and chemically. The most perfect way to cultivate a coconut estate is to spread broadcast a readily assimilable fertiliser and to turn it into the soil, with all the herbage growing on it. The soil will then be improved and not impoverished.

Negombo,

June, 1921.

PROGRESS REPORT OF THE EXPERIMENT STATION, PERADENIYA.

From 1st May, 1921 to 30th June, 1921.

TEA.

4638 lb. of green leaf was plucked from 11 acres in May and 3735 lb. in June.

In each case the best yield was obtained from the old Albizzia plot and the second and third best from the two Dadap plots. Vacancies in the

young Dadaps, put in to replace the old trees in plots 149, were supplied and Dadap stumps were similarly planted in plot 144.

Plots 163 and 164 of young tea, planted in December 1915, were tipped in June.

In the new clearing holing for supplying vacancies was completed and cattle manure applied to every hole.

A proportion of the vacancies were supplied in moderate rain with Dark leaf Manipuri stumps from Kotiyagala. Unfortunately almost unbroken dry weather ensued.

Dadaps and Gliricidia have been lopped in the ½ acre tea clearing.

Shot-hole borer is somewhat more in evidence than in previous years.

RUBBER.

All drains have been cleaned.

Of the various green manures planted in the young rubber at Bandaratenne, Horse gram (*Dolichos biflorus*) and *Sesbania Aculeata* are the only two which have had any marked success in keeping down weeds. The former has formed a dense cover and, while it lasts, should be of considerable benefit. In the old rubber and Avenue rubber 90 acres trees have been marked for thinning.

CACAO.

A very small picking was taken in May. The spring crop was practically a failure owing to the severe drought.

Flowering however has been very prolific and the autumn crop gives every promise of being exceptionally heavy.

The round of canker treatment commenced in April has been completed.

Suckers has been again removed.

All drains have been cleaned.

The manuring of the B. cacoa experiment area was carried out at the beginning of May.

In this area alternate rows of Dadaps have been cut out; the original shade was too heavy and canker was much in evidence. A swarm of locusts has been present for some months in the area under Green Nicaragua Cacao. A quantity of egg masses were dug up in April. The damage done by defoliation of Cacao has been slight. Dadaps have been more severely attacked. In combating the pest some slight success has been obtained by banding the trees with an adhesive substance ("Ostico") and driving the locusts down the trees by smoky fires. Sales of A grade Cacao have been effected at Rs. 40 per cwt.

COCONUTS

A picking was taken in May resulting in 8452 nuts. The previous picking realised 6676 nuts. The young coconut area (Plots 53 to 62) was supplied in June with plants from the Experiment Station, Peradeniya nursery.

The level portions have been ploughed and discharrowed; grass and cheddy have been cut down in the remaining portions.

COFFEE.

All shade has been lopped and suckers removed. A new nursery has been made with a view to coping with the increasing demand for plants of the Robusta types of coffee.

PADDY.

The plot of Heenati sown in May was divided into 3 sub plots (1) seed soaked in water in the ordinary way, (2) seed which sank in a strong solution of common salt, (3) seed which floated in this solution. One measure of each was sown. Unfortunately the unevenness of the soil as evinced by the growth of the paddy will decrease the reliability of the test.

Paddy fly is in evidence and hares have done damage. Latter has been very scarce.

The remaining plots of this area have been ploughed and sown with a selection of manures. The old paddy area with the exception of some plots with defective drainage has been entirely given up to the Economic Botanist.

FODDER GRASSES.

At the end of May it was decided that Natal grass and Bermuda grass gave no promise of utility as fodder grasses. The Natal grass has been uprooted and the adjoining half acre of Rhodes grass extended to form 1 acre. The Bermuda grass plot will be uprooted when labour is available, and a suitable substitute has been decided upon. The plot is at present used for grazing.

½ acre is being planted up with Paspalum dilatatum (Golden Crown grass). The following are average weights per cutting for acre plots excluding the first cutting.

	Average weight per cutting	Average interval between cuttings
Guinea grass A (formerly known as Elephant grass) ...	2·5 tons.	24 days
Guinea grass B (Ordinary Guinea grass)	3·6 ,,	24 days
Water or Mauritius grass (2 cuttings only)	5·1 ,,	44 days
Paspalum Virgatum (2 cuttings only)	2·3 ,,	24 days

These figures are only preliminary. More time is required to reach any conclusive results. The abnormally dry season will have increased the interval between cuttings. All the above grasses are relished by stock, but "Guinea grass A" must not be allowed to grow old and woody.

FOOD PRODUCTS.

The Millets from Sudan and United States, America, have all been attacked by *Cladesporium* fungus and do not appear to be very well suited to this locality. They have been attacked by birds.

3 varieties of cow peas from Fiji have done well and given good crops They are now being planted out on a field scale to obtain yield records.

ECONOMIC COLLECTION PLOTS.

Sixteen plots in the area assigned for the Economic collection for seed purposes have now been planted out and necessary shade and supporting trees for other products have been put in. Dry weather has prevented further planting.

CAMPHOR.

The distillations have been continued but results obtained so far have been disappointing. 38% is the highest percentage of camphor obtained from old leaves and twigs.

From new sheets the percentage has been less. Crushing the leaves between a hand rubber roller has so far produced a slight but no marked improvement. Shortage of water has greatly interrupted the distillations, but they are to be continued until the end of the year.

WEATHER CONDITIONS.

1·76 inches of rain fell in May and 4·07 inches in June. In 1920 the falls were 5·79 and 21·40 showing a deficiency of 21·46 inches this year. Conditions have been most unfavourable for planting. Weeding is the only work which has benefited.

T. H. HOLLAND,
Manager, Experiment Station.

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PESTS AND DISEASES.

REPORT OF THE GOVERNMENT ENTOMOLOGIST ON HIS VISIT TO BATTICALOA IN CONNECTION WITH THE PESTS OF COCONUT CULTIVATION.

J. C. HUTSON, B.A., Ph.D.,
Government Entomologist, Ceylon.

I have the honour to submit the following report on my recent visit to Batticaloa District from April 2nd to 10th inclusive.

2. The main objects of my visit were to inquire into the present status of the three most important insect pests of coconuts and other palms in that district, and to find out what measures are being taken to control them.

3. These three insect pests are (1) the Black-headed Coconut Caterpillar (*Nephantis serinopa*), (2) the Rhinoceros or Black Beetle (*Oryctes rhinoceros*), and (3) the Red Weevil (*Rhynchophorus ferrugineus*). These insects have been prevalent throughout most of the Batticaloa coconut area for many years, and their annual united damage to this crop is considerable.

4. In the Batticaloa District the area under coconuts is confined to a more or less narrow coastal strip extending for about 70 miles. In this area coconuts are not only grown on European and native estates, but are found in the compounds of most villages.

5. During my visit I had the opportunity of seeing the conditions of coconut cultivation on a number of estates, ranging from some of the best

properties to those which are in a more or less abandoned state. I was also able to inspect in detail a few of the towns and villages in the coconut area. During my trip I covered in more or less detail a good part of the coast between Kalkudah and Kalmunai.

6. I will now make some remarks on each of the three pests mentioned above, and outline what I consider to be the best methods of control for each pest, with special reference to the local conditions.

7. *The Black-headed Coconut Caterpillar (Nephantis serinopa)* seems to be regarded as the worst pest of coconuts in the Batticaloa District, perhaps because its injury is very noticeable, and it has the reputation of being responsible for the death of numbers of coconut trees. I saw one area which had been seriously attacked by caterpillars about the middle of last year. Most of the trees had recovered, but there were a number of dead stumps to be seen in this area. The Superintendent said that many of the trees had suffered heavily from this attack, in some cases every leaf on the tree being killed off. Several trees had failed to recover and had been cut down, thus accounting for some of the dead stumps.

8. The estate had changed hands since the caterpillar outbreak, and the conditions are improving rapidly. It still contains, however, one of the most heavily infested "Black Beetle" areas that I saw, and indications of Red Weevil injury are not lacking.

9. It seems highly probable that some of the palms had been so weakened by repeated attacks of the two beetles and doubtless by previous attacks of caterpillar (since this pest is often recurrent in definite areas) that they had been unable to recover from the complete destruction of their leaves caused by the latest caterpillar outbreak.

10. As a result of my investigations of this pest both in the Eastern and Western Provinces, and bearing in mind the discussions I have had with several coconut planters on this subject, I have noted the following points for further investigation :—

11. Where the caterpillar occurs on well-kept estates that—

(a) The pest usually confines its attacks to certain more or less definite areas where the trees are less vigorous than their neighbours, and that it rarely spreads to the more healthy trees ; and

(b) That the caterpillar seems to prefer the older and less vigorous leaves to the younger and healthiest leaves in the crown of the tree.

12. On such estates the pest does comparatively little damage, and the cutting off and burning of infested leaves is a practicable method of control, since it results in the destruction of a larger number of the eggs, caterpillars, and cocoons of the pest without inflicting any serious damage on the tree.

13. Where the caterpillar occurs on neglected estates that—

(a) The pest may spread rapidly over a large area wherever the trees have been weakened by the attacks of beetles and the lack of cultivation and manuring ; and

(b) That the pest often attacks every leaf on such trees, and the weaker trees succumb.

14. In such outbreaks the removal of the infested leaves is hardly practicable as a measure of control.

15. *Control Measures.*—The best general measures for the control of the coconut caterpillar seem to be—

(1) To maintain the coconut trees in a vigorous condition by good cultivation and judicious manuring in conjunction with sanitary methods.

(2) To employ light traps to catch the moths as soon as they emerge and before they are able to lay their eggs on the leaves.

16. In this connection the small kerosene lamps are quite effective, provided that they have a good pan under them, say, of not less than 30 inches diameter, and that they are raised off the ground some 4 or 5 feet. These lamps are comparatively cheap, only costing about Rs. 5 made locally, and would be useful where a number of them must be used to cover a large infested area.

17. The imported acetylene lamps are much more effective, but their cost is, I consider, out of all proportion to their efficiency. They have been found very useful where the pest is confined to small areas on a well-kept estate, and can be kept down by two or three good light traps.

18. In the Batticaloa District outbreaks of the caterpillar seem to occur at almost any time of the year, and planters should be on the look-out for the first appearance of the moths and have their trap-lights ready.

19. *The Rhinoceros or Black Beetle* (*Oryctes rhinoceros*) is quite common in the Batticaloa District at the present time, especially in the immature stages, as will be seen from the following remarks, and a special effort should be made within the next few months to kill as many of the grubs as possible and eliminate their breeding places.

20. In the case of this pest, it is the beetle that does the damage by boring into the crown of the trees and feeding on the sap. The trees so damaged are exposed to the attacks of the red weevil.

21. During my recent trip I was amazed at the large number of old coconut stumps which could be seen almost everywhere on more or less neglected estates and in the gardens and compounds of villagers. Such stumps are a serious danger to the Batticaloa District, since they form one of the breeding places of the Black Beetle at the present time.

22. Many of these stumps are in various stages of decay, some having recently begun to rot at the top of the stem, while in others the stem has completely disintegrated owing to the combined effects of decay and the attacks of the grubs, leaving only a cavity in the ball of roots. These cavities are partially filled with a rich mould and in some cases contain large numbers of active "Black Beetle" grubs.

23. In one area, where there were a large number of dead stumps in all stages of decay, a careful examination was made of 15 of these stumps, the cavities being carefully excavated and an account taken of all the contained grubs. A total of 328 "Black Beetle" grubs was removed from these 15 stumps picked out at random, giving an average of about 22 grubs to a stump. Four of these stumps were found to contain 49, 70, 48, and 44 grubs respectively.

24. In addition to the above, an exhaustive search was made in 35 coconut and palmyra stumps in villagers' compounds. Of these stumps, 12 contained no stage of the beetle, leaving a total of 23 infested stumps containing 219 grubs, averaging over 9 grubs per stump.

25. Altogether the 50 dead stumps carefully examined gave a total of 547 grubs, or nearly 11 per stump. A cursory inspection of many other such stumps indicated that they were similarly infested, but no accurate counts were taken.

26. The above figures serve to indicate that all dead stumps, as soon as they have begun to decay, become attractive to the Black Beetle, and are, therefore, a distinct menace to neighbouring coconut trees. They should be eliminated without delay in the manner indicated below.

27. The Black Beetle was also found breeding in dead standing coconut trees which had lost their tops, and in old decaying coconut and

palmyra stumps lying on the ground. These had evidently been in this position for some time, as they were in advanced state of decay and swarming with Black Beetle grubs when broken up.

28. This pest is also known to breed in manure heaps and in heaps of decaying vegetable matter. I did not find beetle grubs in or around any of the manure heaps examined in towns, as such heaps are generally disposed of periodically to estates. Neither manure heaps nor any heaps of vegetable or animal refuse should be left longer than three months in one spot without being covered with sand.

29. During the storm of January, 1921, several hundred palms were blown down throughout the whole coconut area. These fallen trees are being dealt with in various ways. In towns and villages most of them have been cut up into convenient lengths for fencing and building purposes, after the tops had been burnt. On some estates these trees have been rendered temporarily immune from beetle attack by charring the crowns, but in some cases this has only been partially done, with the result that such stems will soon become liable to infestation by the beetles. The complete destruction of such stems is seldom practicable, but they can be used in various ways as indicated below.

30. It was stated by GREEN in his report on the "Coconut Beetle" in Batticaloa, after the big cyclone (see TROPICAL AGRICULTURIST, November, 1907), that there can be no objection to coconut stems being used for posts for fencing, provided that such employment is really only temporary. The reason for this precaution is that it has been shown repeatedly that fencing made of unsplit coconut stems sooner or later becomes infested by the grubs of Oryctes (Black Beetle). GREEN goes on to suggest that retention of exposed posts or rails (unless split) for a longer period than twelve months should be prohibited under the Pests Ordinance.

31. The above objection, GREEN states, does not hold good in the case of stems used in the construction of buildings, where they will be protected from the action of the weather, and therefore will not decay, and become attractive to the Black Beetle.

32. At the present time the large number of old decaying stumps (see paragraphs 21-26) are undoubtedly the greatest danger to coconuts in the Batticaloa District, and the immediate eradication of these as breeding places is a matter of the greatest importance.

33. When a palm dies, it seems to be the custom to cut it down in such a way as to leave about 2 feet of stem standing above ground. This stem starts to decay within a few months, and a Black Beetle comes along and lays its eggs there. The grubs very soon make a cavity, which forms an ideal breeding place for successive broods. The stem is gradually reduced to a mere shell and eventually collapses. By that time the grubs have hollowed out a cavity within the roots and breed there unnoticed.

34. The eradication of these large masses of roots is impracticable, and in most cases, where the cavity is 2 feet or more in depth, the burning of a fire over the stump would probably not affect the grubs at the bottom. Further, the indiscriminate use of fire in native compounds, especially where the stumps are near buildings or fences, cannot be recommended. Therefore, other methods of treatment must be adopted.

35. It has been found in other parts of the East Indies that these beetles cannot breed in sand or other soil without humus. I would, therefore, suggest the following methods of dealing with all dead stumps :—

(1) Remove and split up all upstanding stumps.

(2) Excavate thoroughly all cavities in the roots and destroy all stages of the beetle found there. This destruction should be carried out immediately on the spot as the grubs rapidly disappear into the ground when removed from their breeding place. The grubs could be collected in a kerosene tin and killed by pouring boiling water over them.

(3) Then fill in the cavity with sand and heap up sand over the ball of roots to the depth of 8 inches. The stump can be left without danger of re-infestation.

36. It is strongly urged that in future all dead palms should be cut through at soil level, and the stumps covered with sand to a depth of 8 inches. This measure will prevent the "Black Beetle" breeding in such places and forming the deep cavities in the roots.

37 With regard to the control of the adult beetles in the crown of the trees, the practice on well-kept Estates seems to be that the beetles are pierced in their holes and extracted by means of a slender sharp-pointed barbed iron. The holes may then be filled in with sand. A mixture of one part coarse salt and two parts sand is used in other countries where the "Black Beetle" is a pest. This method of killing is really only practicable where it is carried out in conjunction with the destruction of the grubs in their breeding places.

38 The "Black Beetle" pest can be most effectively controlled in the grub stage by eliminating its breeding places as indicated above, and this can only be done thoroughly by a systematic campaign throughout the Batticaloa coconut area This should be carried out, not only by all estates, but by the villagers in their compounds. The "Black Beetle" is very prevalent at the present time, and it will take some time before it is got under control, but a start should be made without delay.

39 *The "Red Weevil" (Rhynchophorus ferrugineus)* is also prevalent in the Batticaloa District, and will continue to be so until the "Black Beetle" is controlled. This weevil lays its eggs in all palms which have been injured by the "Black Beetle" by storms or by human agency, and I found several instances where it was breeding freely in recently damaged coconut palms. All the damage to palms is done by the grub, since the weevil does little or no feeding.

40 It was pointed out by BRAND in the TROPICAL AGRICULTURIST for July, 1917, that the "Red Weevil" will attack palms at the top, bottom, and middle, or in any stage of growth, although attacks are certainly much less frequent in hard old stems. Further, that the entrance of the pest is not limited to wounds, but any soft part of the trunk in which the female weevil can insert her ovipositor is sufficient. He goes on to state that a common position for the starting of an attack is under the edge of projecting bark at the base of trees planted too near the surface or on land which is very wet at some period of the year,

41 Such trees with exposed roots and projecting bark are quite common in the Batticaloa District, where some coconut areas are subject to periodic flooding. It is difficult to detect weevil injury in such cases, but it seems highly probable that many such trees are infested with "weevil."

42 I would suggest, therefore, that where practicable all coconuts with their top roots and base of stem exposed should be protected from attack. Such trees would be surrounded with a heaped ring of coconut husks to form a retaining barrier, and then the intervening space could be filled in with soil. If it were found later that the husks or other material attracted the "Black Beetle," then the barrier could be covered with heaped sand. I do not know how far such a measure would be practicable under

estate conditions, but it should be given a trial, as it would not only protect a vulnerable part of the tree from weevil attack, but it will also tend to improve the general condition of the tree.

43 During my visit I came across a few young coconut trees that had either been blown over or snapped off, or had suffered serious damage from other causes. I could not ascertain with any degree of certainty how long ago these injuries had taken place. These palms had apparently been left untouched and were swarming with practically all stages of the Red Weevil from newly hatched grubs to the adult weevils just ready to emerge from their fibre cocoons.

44 It has been repeatedly shown that the Red Weevil is attracted to damaged palms within a few hours of the injury, and that under favourable conditions it breeds rapidly and many reach the adult stage within a few weeks. All such infected palms are a danger to the surrounding coconut cultivation, and immediate steps should be taken to remove all further danger of infestation. Such breeding places are not uncommon in villagers' plantations, and yet nothing has been towards their removal.

45 Injury by the Red Weevil can be further lessened by avoiding all unnecessary injury to coconut palms. Such injury would include the forcible stripping of palm leaves, the barking of trees by wheels of passing carts, the making of wounds with knives or other implements.

46 I have appended a summary at the end of this report outlining briefly the habits of the three pests and methods of control which can be employed.

47 In conclusion, I desire to express my thanks to the Government Agent, Eastern Province, for the interest he has taken in my visit, and for his courtesy in arranging an itinerary for me and putting the Government car at my disposal whenever possible.

SUMMARY.

A.—The Black-headed Coconut Caterpillar (*Nephantis serinopa*) attacks the under side of palm leaves causing them to wither and die in the case of bad outbreaks. Partially attacked leaves are not seriously affected. Weak trees suffer more than the healthy ones and appear to be more favoured by the pest. On well-kept Estates the pest is generally confined to comparatively small definite areas and rarely spreads, but on neglected estates large areas may be attacked, sometimes every leaf being killed off. Weak trees may be killed off.

CONTROL MEASURES.

1. Keep the estate as clean as possible and the trees in a vigorous condition by cultivation and manuring and by controlling the two beetle pests, whose attacks serve to weaken the trees.

2. The moths are attracted to lights. Therefore, employ trap-lights to catch them as soon as they become noticeable. A number of small kerosene trap-lights are probably more effective, where the pest covers a large area. A few powerful acetylene lamps are very effective for a small definite area, but these are expensive as compared with the kerosene trap lights, which can be made locally for about Rs. 5.

3. The removal and burning of infested branches is practicable in a small outbreak, or where only a few leaves are attacked. By this method the eggs, caterpillars, and cocoons of this pest are destroyed.

B.—*The Rhinoceros or Black Beetle* (*Oryctes rhinoceros*) is very numerous at the present time, especially in the grub stage. The grubs or larvæ breed very freely in dead stumps of coconut and palmyra palms, and there are hundreds of such stumps scattered throughout the Batticaloa District at the present time, chiefly on neglected or partially abandoned estates and in villagers' compounds.

In the case of this pest, it is the beetle stage which does the damage by boring into the crowns of trees and feeding on the sap. Unless such holes are plugged up, they serve as sources of infestation for the Red Weevil, the grubs of which bore down into the stems.

The "Black Beetle" grubs do not damage living palms, but feed only on decaying vegetable refuse, such as rotting stems lying on the ground, dead stumps, rubbish heaps, and heaps of animal manure.

CONTROL MEASURES.

For the Grubs.

1. Cut down all dead palms at ground level and cover the stumps with 8 inches depth of sand.

2. Treat all dead stumps in a similar way, and then clean out the cavities in the roots, being careful to destroy all grubs immediately. Then fill in the cavities with sand and cover with an 8-inch layer of sand. 1 and 2 are the most important measures at the present time.

3. Cut off and burn the tops of all fallen coconut and palmyra palms. The stems can be cut into convenient lengths and used for building purposes, provided that the ends are protected from the action of weather.

4. Unsplit coconut logs used for fence and gate posts and for bridges must only be so employed temporarily and must be renewed every twelve months, as they are liable to decay after some months' exposure to the weather. There is no objection to using split logs for fences, posts, etc.

5. Split and burn all decayed coconut stems taking care to destroy the contained grubs. The disposal of such stems should be a simple matter as most of them are in an advanced state of decay.

FOR THE BEETLE.

1. Probe the holes in the crowns of trees with a slender sharp pointed barbed iron to kill and extract the beetles.

2. Fill up the holes with a mixture of one part coarse salt and 2 parts sand and plug with clay where practicable.

This measure against the beetle is of little use unless the breeding places of the grubs are dealt with at the same time.

C.—*The Red Weevil (Rhynchophorus ferrugineus).*—This is a more dangerous pest of coconuts than the "Black Beetle," since the grubs are capable of killing palms by tunnelling in the stems. The weevil is attracted to lay its eggs in any wounds or injury to trees, and the grubs breed very rapidly, often without their presence being detected until the tree begins to die. Young trees are much more liable to attack than old ones.

CONTROL MEASURES.

1. Cut off and burn the tops of fallen trees and dispose of the stems as for Black Beetle.

2. Cut down all the badly damaged young palms to ground level and treat the stumps as above. Dispose of the stems as above.

3. Avoid all artificial injury to palms, such as stripping of leaves, injury by estate carts, wounds from knives, etc. Leaves should be cut off and the ends tarred (where removal is for coconut caterpillar,) or should be allowed to fall naturally. All wounds should be tarred over.

4. In lands which are periodically flooded or where trees have not been planted deeply enough, cover up the exposed roots and base of the trees with soil and surround trees with a barrier. Both the beetles are declared pests, but very little action seems to be taken to control them.

A general measure for the two beetles is to keep an estate in a clean, sanitary condition, and the trees as vigorous as possible.

J. C. HUTSON,
Government Entomologist.

Peradeniya, April 21, 1921.

AGRICULTURAL EDUCATION.

AGRICULTURAL EDUCATION IN THE PHILIPPINES.

KILMER O. MOE,

Superintendent, Central Luzon Agricultural School.

The OLD ORDER CHANGETH.

The Filipino people are passing through a period of economic and social transformation What changes a few short years have brought about ! A spirit of modernity is carrying the country forward (let us hope upward) at an accelerating speed which is somewhat bewildering. The old reactionary type makes a pitiful attempt when he tries to curb this forward rush and finds to his dismay that he himself must needs readjust his ideas or fall by the wayside. Who dares attempt to stop the wheels of progress ?

This new order manifests itself in a hundred different ways—in dress, in social usage, in higher standards of living—in fact, in every way which makes for a higher degree of civilization for the great mass of Filipino people. Economic and social progress seem to be pressing forward with an irresistible force. Judging from conditions ten or fifteen or twenty years ago, who would have thought to have seen so many changes in such a short period of time ?

A HIGHER STANDARD OF LIVING.

The great outstanding fact is that the progress is not a surface indication but a deep rooted and national growth. It has taken possession of every province, and can be traced even to the farthest barrio. This great forward movement owes its existence largely to the education of the masses. Every governmental agency has fostered economic and social welfare, but none more than the public schools. Through education the masses have learned and are learning in an ever increasing degree to appreciate the better things of life and have developed a standard which is perhaps the highest of any in the Far East. The Filipinos are learning how to live. They are expending their energies in securing the means by which to maintain this higher standard. Good clothes, automobiles, better homes, sewing machines, phonographs, and other commodities are of common use throughout the Philippines. The educational forces have created desires for better things and the gratification of these desires stimulate not only the economic and social welfare of the people but create a demand for articles of commerce in large quantities and consequently serve to stimulate trade and industry.

GREATER APPRECIATION OF THE PRODUCER.

The most remarkable phase of this forward movement is the favourable attitude towards agriculture. You no longer see a farmer cringe before the professions of law and medicine. He is inclined to throw out his chest and

proclaim to all the world that he is a producer—an agriculturist—one who creates wealth for the nation and as such entitled to the best the country affords. And, what is more, he is going to get it. No leader who values his future career dares to go contrary to the interests of the producer. The great source of wealth in the Philippines is that of agriculture. The economic prosperity and social welfare of the Filipino people rest squarely on a foundation of increased agricultural production.

ECONOMIC LEADERS NEEDED.

The great need of the hour is for more intelligent leadership. This is a wonderful country with wonderful resources, but the forces of production need organization and direction. The young men of the country must prepare themselves to direct these forces. Land we have in abundance; our agricultural population is anxious and willing to increase its earnings and thereby maintain a better social and economic standard but lacking in initiative and leadership, plods along with antiquated methods and small returns.

Every Filipino who has the welfare of his country at heart should realize that it is his patriotic duty to help in every way possible to increase production and to improve the living conditions of the agricultural classes. Citizens of this country who have the qualities of leadership may well demonstrate their ability by becoming economic leaders. Their places are to direct the economic forces of the country. One who aspires to real leadership has here a wide field in which to exercise his talents. Let this be a call to every young man in this country who possesses courage and ambition and who has enough practical ability to accomplish results. Without intelligent leadership the Filipino farmer, as a class, is powerless to escape from the conditions that now prevail. Restrictive laws do not relieve the situation, only by constructive action may we hope to accomplish results worth while.

WASTE.

It is a waste to permit, 5,529,000 hectares of the country's most fertile land to lie uncultivated. It is also a waste of the natural resources to permit the farmers' sons to be educated along lines which make it seem undesirable for the boys to return to the farm and to give agriculture the benefit of the training received during school days.

Only agricultural education will solve this problem of waste. It takes an intelligent farming class to know the resources of other provinces and to have the courage and confidence to leave friend and home, and to settle on undeveloped lands with strange surroundings. The Philippines must provide schools to develop the educated man who will seek out his ideal in the form of a productive farm.

Agricultural school graduates will go into isolated sections without fear of people or locality, and will spend their time and energy in the development of the soil, as was shown when new schools were opened in the wild and isolated regions of Mindanao and Sulu. The graduates of the Central Luzon Agricultural School were the only young men who were willing to accept these stations.

A SYSTEM OF AGRICULTURAL EDUCATION.

The time has arrived for putting into effect a system of agricultural education in keeping with the needs of the country. Headed by the University this system should be national in its scope and should be extended

to all provinces. The Philippines, just now, are merely at the beginning of industrial development. Modern methods in both fields and factory are being introduced very rapidly. Lack of men capable of making a success of productive enterprises is retarding development more than any other single factor.

The first and most necessary step in fostering the economic development of the country is that of providing facilities whereby the young men of the country may receive the necessary training to operate machinery, to manage productive enterprises, to handle men, and to carry on the work demanded by the industrial development. A survey of the industrial conditions at the present time reveals a deplorable situation. The industries are outgrowing their personnel. In the sugar industry, for example, foreigners are used as field foremen, machinists, factory overseers, and chemists at five times the salary received by Filipinos. We need men trained to carry on the work in the sugar industry, in the coconut oil industry, in the tobacco industry, in the fibre industry, and in the production of food crops.

A complete system of agricultural education is one which takes into consideration the pressing needs of the country and provides facilities whereby specific training along lines that count in economic development may be afforded. This will mean special schools for every industry; it will mean a tobacco school in the Cagayan Valley, a sugar school in Negros, a rice school in Central Luzon, a coconut school in Tayabas, a fibre school in Leyte, and a fruit school in Batangas. Nor is that all. It will mean more than everything—a development of the College of Agriculture along lines whereby the training of men can be promoted. The special schools in the provinces cannot possibly produce college trained men. They can only afford training to the great mass of industrial employees. Those who are to serve as technical men or leaders of large enterprises must necessarily continue courses in higher institutions of learning which offer specific training.

We need industrial chemists in the sugar and oil industries. To give impetus to this training it would seem that the College of Agriculture should be provided with facilities in way of a sugar central and a central for the manufacture of coconut products at the earliest possible date in order that the men turned out may be efficient as leaders in these industries. It may be said without fear of successful contradiction that the most important institution in the development of agricultural education is the College of Agriculture.

In fact the whole scheme must be so well organized and directed that every branch of the service will contribute to the general purpose of training for service. The schools which are established should be well equipped and should co-operate with the established industries in such a manner that the young men of the country will turn their energies into productive channels rather than become "job hunters" and clerks. The general attitude towards agricultural education should be one of helpful co-operation with the definite purpose of leading the future citizens of the country into productive enterprises.

TEACH IN TERMS OF LIFE.

Boys and girls must be taught in term of their life's work. Public sentiment is demanding that it be done. The coming generation must assume

the burden of performing the world's work, and fitness is essential to do good work. There must be fewer words. Words will not plough a field; words will not build a home; words will not develop a great humanity, nor build a great nation. Teaching in terms of the lives of the people is the Big Idea in Education.

The Filipino people are primarily agriculturists and there must be more agricultural education. We have had marvellous educational growth in the Philippines in recent years, yet our school system as a whole does not measure up to the needs of to-day. If we are to keep the Philippines safe from food shortage it must be through the medium of an intelligent citizenship in the Philippines. We must provide the right kind of training for both the boy who lives in the city and the boy who lives in the country. Children should be educated so that they will work with their hands as well as with their heads.

Without agricultural schools which will train for country life, and which will deal with country problems, the Philippine schools will force the farmers' sons directly away from the farm. A boy cannot be expected to return to the farm if, during the larger part of his life, he has spent his time studying books, dead facts, dates and words which have no bearing on the vital interests of country life.

We know how enthusiastic a child starts to school and how anxious he is to learn. We also know with what enthusiasm his interest is centered in his garden. This interest in agriculture should be kept up, and the boy should be given real things to do. Let him begin to solve real problems in crop production. Let him learn how to manage farm land and to rotate crops so as to produce enough to pay the rent or the interest on his investment.

Our barrio schools train one-half of our boys and girls. Half of our population receive here their training for life. These schools must meet the country's needs. We find that there are an insufficient number of these schools where boys may receive practical training in farm work during the entire period that they remain in school. The children should be taught in terms of home-making. An agricultural school exerts this influence on the social and business life of the community and it is regarded as something in common with the real life of the people.

The desire for better things is a power for good and if tempered with reason will accomplish wonders in way of economics and social progress. But it is necessary for us to deepen, broaden and enlarge our conception of education and what it means in the up-building of the nation. In the language of Dr. Frank Crane: 'There can be no salvation for the race that does not first mean salvation for the child, by striking from his brain the chain of ignorance, from his heart the iron rim of superstition, and from his hands the curse of the unskilled."—Philippine Farmer, Vol. VII, No. 4.

GENERAL.

THE CAROB AND ALGAROBA BEANS.

C. T. WHITE, F.L.S.,

Government Botanist.

For some time past the Department of Agriculture and Stock and private persons have been importing into Queensland seeds of both the Carob and Algaroba Beans. As the former is also often called the Algaroba, and is in fact the original Algaroba, there has been some confusion in the popular mind between these two trees. This is unfortunate, as they are widely different in appearance, and whereas the one is only suitable for cultivation in the cooler parts of the State, the latter is more particularly adapted for the warmer. As both trees, though of considerable economic importance, are little known to many persons in Queensland, the following article is offered. For the sake of convenience the name Carob is here applied to *Ceratonia siliqua* and the name Algaroba is confined to *Prosopis juliflora*, as it is to this latter tree that now-a-days the name Algaroba seems most commonly applied.

CAROB BEAN *(Ceratonia siliqua)*

Description.—A tree 20 to 30 feet high, leaves pari-pinnate, each leaf composed of 3 to 8 pairs of leaflets; leaflets oval, entire, paler on the under surface, coriaceous in texture, 1½ to 2 in. long, 1 to 1½ in. broad. Flowers Polygamous, greenish, small, in short racemes, calyx small, soon falling off, corolla none; stamens five, pistil glabrous, in male flowers abortive, in female and hermaphrodite shortly stipitate, ovary several-ovulate, style 3 to 4 in. long flattened, indehiscent; seeds dark reddish brown, 3 to 4 lines diameter, enclosed in scarlet sugary pulp.

Note on the Flowers.—Like another well-known plant—the Papaw—the flowers are polygamous—i.e., the flowers may be distinctly male or female and borne on different trees, or hermaphrodite—i.e., male organs (stamens) and female organs (pistil) growing in the same flower. This latter condition, however, is apparently rare, the majority of the trees being distinctly either male or female.

Distribution.—A native of the Mediterranean region (Southern Europe, Western Asia, North Africa). Cultivated in most warm temperate countries.

Botanical names.—Keratea, the ancient Greek name of the tree, is most likely the origin of the generic name. *Siliqua*, Latin, meaning the pod or husk of leguminous plants.

Common names.—Carob Bean, St. John's Bread, Locust Tree.

In his Encyclopædia of Plants, J. C. Loudon has the following very

interesting statement:—"The pods contain a sweet fœcula for the sake of which they are often imported into England under the name Algaroba Beans. This word is a slight alteration by the prefix of the article *al* of the Arabic word Kharroub, whence also our English name Carob. This is generally considered the Locust Tree of Scripture. The tree is also very common in the south of Spain and often formed the principal food of the British cavalry horses during the war of 1811 and 1812."

Cultivation.—F. TURNER, writing in the AGRICULTURAL GAZETTE OF N.S.W., states:—"The best time of the year to sow Carob seed is in August. The outer covering of the seed is very hard, and before they are sown they should be placed in an earthen vessel and hot water poured on them, then kept near the fire till they soften. The seeds should be planted in boxes or pots and the seedlings, when strong, say about six months old, transplanted into their permanent quarters." It can also be propagated by cuttings, and on this method MR. TURNER has the following remarks to make:—"For putting in cuttings, March or April is the best month. Cuttings of the ripened wood of the current season's growth, about 6 in. long, and either heeled or cut just below a joint; the leaves should be shortened. They will strike more readily if put singly into boxes filled with sandy soil and kept in a shady situation until rooted, when they should be gradually inured to sunlight. The cutting should be rooted and ready for transplanting in about six months' time. Layers, of course, are only possible when branches are near the ground." The great advantage of propagating by cuttings, layers, or grafting is that female or pod-bearing trees can be obtained when necessary, whereas with seed one has to take the chance as to the relative numbers obtained of male and female plants, and no distinction even to the trained eye can be seen between the plants in a young stage—i.e., before flowering.

The tree can be grown in the Brisbane district, but it is doubtful if it would succeed much further north, being more adapted for the cooler parts. It does well on the Darling Downs and similar localities, provided the frosts are not too severe.

As already explained, the trees are unisexual, i.e., distinctly male and female; hence for pods to be formed there should be a proportion of male trees among the female to ensure fertilisation, otherwise the pods will fall off before maturity. In his article MR. TURNER goes on to state:—"If it should happen that all the trees in a group should produce female flowers only, branches bearing male flowers can safely be brought from a distance and hung among the branches bearing female ones so as to effect fertilisation. I have known this to be done with trees growing 14 miles apart and be successful. Persons who grow Carobs should keep a few bees, if it is only one hive; it is astonishing the number of flowers these insects will visit during the course of a day and be the agency whereby many of them are fertilised."

ALGAROBA OR MESQUITE BEAN *(Prosopis Juliflora.)*

Description.—A tree attaining 60 to 70 ft., branching usually armed with straight spines, either solitary or in pairs. Leaves bipinnate, usually occurring in little tufts or fascicles, pinnæ 1, 2, or rarely 3 pairs; leaflets usually 10 to 12 pairs, oblong, 3 to 4 lines long. Flowers small and numerous, borne in long slender spikes of 3 to 5 in. Pod yellow, shortly stalked, 5 to 8 in. long, marked between the seeds with transverse lines, fleshy with a sweet, sugary, more or less spongy pulp; seeds light-brown, enclosed in a hard, parchment like casing (endocarp.)

Distribution.—A native of South America, West Indies, Central America, Mexico, and the Southern United States.

It is now widely cultivated in tropical countries as a fodder and ornamental tree. Speaking of its introduction into the Hawaiian Islands, J. F. ROCK in the LEGUMINOUS PLANTS OF HAWAII, states :—"The Algaroba is the most common as well as the most valuable tree introduced into the Hawaiian Islands. All the waste lands which previous to the introduction of this valuable tree were absolutely barren are now covered with green forests made up exclusively of this tree. The tree was introduced by FATHER BACHELOT in 1828, the seed having come from the Royal Gardens at Paris, France."

Botanical Name.—Prosopis, origin obscure; "Prosopis" was a name given by DIOSCORIDEL to the Burdock *(Arctium lappa)*, a plant very dissimilar to any species of Prosopis. It bears spiny burrs, however, and this may have led LINNAEUS to bestow the name Prosopis on these trees on account of their spiny nature; *juliflora*, flowers in July.

Cultivation.—Seeds should be sown in the spring or early summer. The pod contains up to about 20 seeds. Each seed is surrounded by a hard parchment-like casing. This should be removed with a sharp knife before the seeds are sown. C. S. JUDD, writing in a recent number of the HAWAIIAN FORESTER AND AGRICULTURIST, found that pouring hot water over the seeds and letting them soak for twenty-four hours greatly accelerated their germination, but they may be sown without any treatment at all, germination then, however, being considerably slower. They should be sown in pots or boxes and when strong enough the young trees can be planted out into their permanent quarters.

As in this tree the flowers are hermaphrodite, there is no need to worry over their fertilisation as in the Carob.

This tree succeeds well in the Brisbane district and fruits well. It is doubtful if it would succeed much further south, but is more particularly adapted for growing in the warmer parts of the State.—QUEENSLAND AGRIC. JOURN. VOL. XV, PART 6.

WORLD'S RICE PRODUCTION.

The following figures are extracted from the International Crop Report and Agricultural Statistics published by the International Institute of Agriculture—(Bureau of Statistics) for April, 1921, and should prove of interest. The yields are given in Centals (= **100 lb. weight**):—

COUNTRY	AREA					YIELD (1)				
NORTHERN HEMISPHERE	1920	1919	Average 1914 to 1918	Percentage for the most recent year: 1919 = 100	Percentage for the most recent year: Average = 100	1920	1919	Average 1914 to 1918	Percentage for the most recent year: 1919 = 100	Percentage for the most recent year: Average = 100
	thousand acres	thousand acres	thousand acres	%	%	thousand centals	thousand centals	thousand centals	%	%
EUROPE										
*Bulgaria	7·7	4·4	8·4	172·2	91·2	134·0	52·9	93·5	253·3	143·4
*Spain	119·8	112·2	102·6	106·8	116·9	6,378·9	6,673·2	5.153·5	95·6	123·8
*Italy	281·7	325·4	350·6	86·6	80 3	9,495·3	10,729·9	11,797·0	88·5	80·5
Portugal	—	43·5	21·6	—	—	—	441·2	414·1	—	—
AMERICA										
*United States	1,337·0	1,091·8	892·9	122·5	149·7	24,169·5	19,255·5	15,012·0	125·5	161·0
*Guatemala	6·4	13 6	24·0	47·3	26·8	36·2	84·0	212·3	43·0	17·0
British Guiana	—	61·0	54·7	—	—	—	1,672·2	1,370·7	—	—
Dutch Guiana	—	—	—	—	—	—	—	(3) 116·8	—	—
Mexico	—	—	(4) 41·8	—	—	—	—	(4) 501·6	—	—
ASIA										
Andaman and Nicobar	—	—	(5) 3·7	—	—	—	—	(5) 43·4	—	—
Ceylon	—	—	704·8	—	—	—	—	—	—	—
French Settlements in India	—	—	42·8	—	—	—	—	537·9	—	—
Federated Malay States	—	—	(3) 135·7	—	—	—	—	(3) 11,618·6	—	—
*British India	78,023·0	79,426·0	78,607·0	98·2	99·3	967,026·4 (627,939·2)	1,102,837·1 (716,128·0)	1,067,858·2 (693,414·4)	87·7	90·6
Indo-China	11,761·7	—	10,151·5	—	115·9	101,797·0	—	119,203·5	—	85·4
Japan	—	7,608·5	7,517·8	—	—	247,775·3 (195,247·0)	242,469·4 (191,065·9)	223,771·5 (176,332·0)	102·2	110·7
Korea	—	—	(3) 2,749·3	—		—	—	47,297·5	—	—
Formosa	1,213·0	1,227·1	(2) 1,191·4	98·9	101·8	19,604·2	19,199·5	(2) 18,813·6	102 1	104·2
*Philippines	3,669·3	3,413 4	3,019·8	107·5	121·5	22,474·0	32,024·5	23,795·3	70·2	94·4
Russia	—	—	(6) 650·0	—	—	—	—	(6) 7,226·8	—	—
AFRICA										
*Egypt	(7) 139·9	149·7	237·3	—	—	(7) 10,278·0	9,831·3	6,548·2	—	—
Sierra Leone	—	—	(3) 250·1	—	—	—	—	(3) 2,912·1	—	—
AMERICA										
Hawaii	—	—	(5) 4·0	—	—	—	—	(5) 112·0	—	—

WORLD'S RICE PRODUCTION.—*Contd.*

Southern Hemisphere	1920-21	1919-20	Average 1914-15 to 1918-19	1919-20 = 100	Aver. = 100	1920-21	1919-20	Average 1914-15 to 1918-19	1919-20 = 100	Aver. = 100
AMERICA										
Paraguay	—	—	(8) 2·2	—	—	—	—	(8) 32·4	—	—
Peru	—	—	(9) 67·1	—	—	—	—	(9) 1,155·9	—	—
ASIA										
British North Borneo	—	—	(9) 56·1	—	—	—	—	(9) 406·3	—	—
Dutch East Ind. *Java and Mad.*	8,060·3	8.465·1	6,849·8	95·2	117·7	104.980·6	114.233·5	96,540·5	91·9	108·7
OCEANIA										
Fiji Islands	—	—	(10) 14·6	—	—	—	—	(10) 418·4	—	—
Totals and index numbers for countries marked	**91,645·1**	**93,001·6**	**90,092·6**	**98·5**	**101·7**	**1,144,972·9**	**1,295,721·9**	**1,227,010·5**	**88·6**	**93·5**
World's Yield	—	—	—	—	—	—	—	*4,400,000*	—	—

(1) The yield is stated in rough rice. For countries which make up their data in terms of cleaned rice, we have inserted the original figures in brackets—(2) Average 1914 to 1917.—(3) Average 1914 to 1916—(4) Average 1914, 1916 and 1918—(5) Average 1916 to 1918—(6) Average 1914 and 1915. —(7) Not including the *Nili* crop which amounted during the four years 1916 to 1919 to about 10% of the total—(8) Average 1914-15 1915-16 and 1917-18—(9) Average 1914-15 to 1917-18—(10) Average 1914-15 to 1916-17.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 31st July, 1921.

Province, &c.	Disease.	No. of Cases up to date since Jan. 1st. 1921.	Fresh Cases	Recoveries.	Deaths.	Balance Ill.	No. Shot.
Western	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	83	1	82	—	1	—
	Anthrax	—	—	—	—	—	—
Colombo Municipality	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	88	—	—	—	—	—
	Anthrax	—	—	—	—	—	—
	Rabies	2	—	—	—	—	—
Cattle Quarantine Station	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	51*	—	Up to	July	16th	1921
	Anthrax	303†	60				
Central	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	13	—	13	—	—	—
	Anthrax	—	—	—	—	—	—
	Piroplasmosis	7	1	4	3	—	—
Southern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	35	—	35	—	—	—
	Anthrax	—	—	—	—	—	—
Northern	Rinderpest	Free					
	Foot-and-mouth disease						
	Anthrax						
Eastern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	184	43	166	9	9	—
	Anthrax	—	—	—	—	—	—
North-Western	Rinderpest	36	—	11	23	—	2
	Foot-and-mouth disease	—	—	—	—	—	—
	Anthrax	—	—	—	—	—	—
North-Central	Rinderpest	Free					
	Foot-and-mouth disease						
	Anthrax						
Uva	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	399	7	382	10	7	—
	Anthrax	—	—	—	—	—	—
	Hæmorrhagic Septicæmia	20	20	2	18	—	—
Sabaragamuwa	Rinderpest	Free					
	Foot-and-mouth disease						
	Anthrax						

* 7 cases occurred amongst sheep and goats. † occurred amongst sheep and goats.

Colombo, 3rd August, 1921. G. W. STURGESS, G.V.S.

METEOROLOGICAL.

JULY, 1921.

Station	Temperature: Mean Daily Shade	Temperature: Difference from Average	Mean Humidity	Mean amount of cloud 0=clear. 10=overcast	Mean Wind Direction during month	Daily Mean Velocity.	Rainfall: Amount	Rainfall: No. of Rainy days	Rainfall: Difference from Average
	°	°	%			Miles.	Inches		Inches
Colombo Observatory	82·0	+ 1·0	77	8·6	WSW	158	5·12	13	- 0·72
Puttalam	82·2	+ 0·6	78	5·3	SW	287	0·92	3	+ 0·39
Mannar	84·7	+ 1·1	74	8·4	SW	168	0·37	1	- 0·03
Jaffna	83·4	+ 0·4	82	7·6	SW	348	1·01	3	+ 0·05
Trincomalee	83·8	- 1·4	72	8·2	SW	232	2·21	6	+ 0·10
Batticaloa	85·2	+ 0·6	—	—	—	—	3·20	6	+ 1·94
Hambantota	82·3	+ 0·7	75	5·4	WSW	380	2·73	11	+ 1·17
Galle	80·1	+ 0·1	84	6·3	WNW	315	6·61	21	+ 0·59
Ratnapura	80·4	0	82	7·6	—	—	10·17	25	- 2·72
Anu'pura	82·6	- 0·7	72	6·5	—	—	3·16	6	+ 1·89
Kurunegala	81·2	+ 0·6	76	9·0	—	—	6·68	16	+ 2·78
Kandy	76·6	+ 0·8	78	8·6	—	—	8·15	23	+ 0·74
Badulla	74·6	- 0·7	78	7·5	—	—	2·42	13	+ 0·39
Diyatalawa	70·5	+ 0·6	69	6·6	—		2·18	11	- 0·02
Hakgala	61·6	+ 0·4	84	8·8	—	—	6·59	20	- 0·26
N. Eliya	60·4	+ 1·5	87	9·1	—	—	11·65	25	- 0·24

July may be divided into three main periods. From the 1st to the 9th the wind was normal, but the rainfall was far below normal From the 10th to 21st the pressure gradient was unusually smooth, and wind directions were correspondingly less regular, including north wind at Colombo on the 11th and a severe, but local, whirl at Veyangoda on the 20th. During this period there was a noteworthy absence of rain of the normal South-west type but there were some thunderstorms, particularly on the east side.

On the 21st the gradient became slightly steeper and on the 22nd a further steepening justified its description as of practically normal type for July, which type persisted till the end of the month with the full complement of rain.

The rain during this last week served to bring the monthly totals up to their average at about half the stations in the island.

The extreme south coast and Deniyaya stations were slightly above average, as were Ratnapura and the country east of it. The remainder of the island south of the latitude of Colombo was for the most part below average—deficits of the order of 2 inches were common on the west, while on the east the offsets were usually less than this.

The rainfall was above average along the west coast from Negombo to Chilaw and eastward of this line, including the south of the North-Western Province and the districts of Kegalle, Matale, and most of Pussellawa.

One or two stations in the Trincomalee district were 3 or 4 inches above average but except for them offsets of as much as 2 inches from average were not found north of Dambulla.

Humidity was below average at the coast stations except Trincomalee but above it at Nuwara Eliya and the up-country stations further east.

Temperature and amount of cloud amount were both above average on the whole, while the numerical means of barometric pressure and wind velocity were not far from normal.

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